

**ACIAR SRA LS/2024/144 Official Trip Report:
Holistic training, baseline surveys and partnership development for Black Soldier Fly farming in PNG**

1. Name:	Arthur Roberts (Mr.) and Janet Pandi (PhD) – ACIAR SRA Project Leaders NARI Livestock Research Scientist, PNGUoT School of Agriculture, Senior Lecturer – Animal Science
2. Itinerary:	<p>On the 12/01/25, team left Labu for Nadzab. Departed Nadzab at 118:00hrs to Jacksons, arrived at 19:10hrs. Checked in at Sanctuary Hotel at 20:40hrs. Debriefing on activities, stakeholder visits and survey reviews. Returned on Friday the 17th February 2025, 1410hrs.</p> <p>NARI Staff & Partners on the trip are</p> <ol style="list-style-type: none"> 1. Arthur Roberts – MRC, NARI 2. Janet Pandi (PhD) – PNGUoT 3. Michael Dom (PhD) - NARI 4. Simon Sangi – SRC, NARI 5. Marvin Uriye - SRC, NARI (Laloki – Driver on Project) <p>All travel costs and accommodation covered by ACIAR SRA including stakeholder refreshments, fuel & mileage hire for SRC Laloki. Storage devices (flesh drives) were also purchased to share information such as images, videos, literature on BSF, articles, posters etc. with an end survey dinner on Thursday the 16th February with the Laloki team.</p>
3. Purpose of Travel	<p>SRA Output A:</p> <ol style="list-style-type: none"> 1. Conduct willingness To Pay (WTP) BSFL as feed source for livestock 2. Farmer and Consumer perceptions of insect-based feeds for livestock Survey <p>SRA Output B – Waste Mapping Survey</p> <ol style="list-style-type: none"> 1. Initiate Waste Mapping sites and surveys on wastes streams 2. Partnership development with public/private stakeholders – POM pilot site 3. Visit pilot & potential sites for BSFL rearing 4. Introduce BSF technology for managing wastes and producing useful by-products in the form of BSFL as protein feed and fertilizer frass as a soil amendment.

4. People met/ visits	<p>STAKEHOLDERS & PARTNERS</p> <p><u>13th of January, 9:40am</u></p> <p>A. Met with the National Capital District Commission (NCDC), Municipal Waste Management Division,</p> <ol style="list-style-type: none"> 1. Mr. John Navara – Divisional Manager 2. Mr. Ronnie Ranu – Senior Waste Manager/Data Analyst 3. Mrs. Vivianne Morofa – Landfills Coordinator 4. Ms. Racheal Inamuka – Circular Waste Coordinator 5. Ms. Filma Henry – Market Waste Coordinator 6. Mr. Paul Wisi – Senior Waste Coordinator <p><u>14th Of January, 10am</u></p> <p>B. Met with the National Fisheries Authority (NFA), Inland Fisheries – Aquaculture and Inland Fisheries Unit</p> <ol style="list-style-type: none"> 1. Ms. Lina Pandihau – Manager for Inland Fisheries 2. Mr. Jeffery Puri – Industrial Development Officer 3. Mr. Joshua Noiney – Research Officer, Aquaculture 4. Mr. Presley Kokwaiye – Fisheries Development & Liaison Officer 5. Mr. Ghandi Tarube - Fisheries Development & Liaison Officer <p>C. Met with the National Institute of Standards & Industrial Technology (NISIT), Standards Development Division</p> <p><u>15th of January, 2pm</u></p> <ol style="list-style-type: none"> 1. Ms. Miriam Idok – Executive Manager, Standards Division 2. Noah Bogosia – Manager, Products, Process & Systems 3. Aaron Kemeta – Biology Standards, Coordinator 4. Max Kadobu – Industrial Chemistry Standards, Coordinator <p>Scheduled meetings cancelled due to absence of key personal.</p> <p>D. National Department of Agriculture & Livestock (NDAL)</p> <ol style="list-style-type: none"> 1. Ms. Reggina Nbi 2. Mr. Francis Konsii 3. Ms. Heai Centre <p>E. Edai Town/Boera Community</p> <ol style="list-style-type: none"> 1. Kym Wong – CEO of Edai Town Community Engagement 2. Sir Moi Ave – Representative of Borea <p>LIVESTOCK FARMERS</p> <ol style="list-style-type: none"> 1. RADHO Piggery, Mr. Mathew Kunba, Operations Manager 2. 14 Mile Agro-Farm, Owner Mrs. Monica Kaupa 3. Bomana Egg Layer Farm, Mr. Nicolas Tarlio 4. Broiler Chicken farmer, Felix Peter (Gorden’s Market) 5. Agro farm, Desh Besh <p>SITE VISITS</p> <ol style="list-style-type: none"> 1. BARUNI landfill processing center (NCDC) 2. RADHO Piggery 3. 14 Mile Agro-Farm
5. Major Events	<p>A. NCDC – 13th of January 2025, 9.30am</p> <ul style="list-style-type: none"> • Met with Mr. John Navara and the NCDC waste management team to introduce the ACIAR SRA project and its objectives. • Presented the Black Soldier Fly (BSF) technology for organic waste management through literature, videos, and discussions. • NCDC expressed interest, citing alignment with their projects under CEPA J-PRISM, SPREAP, UNEP, and Climate Change Environmental Impact Assessments.

- Noted NARI’s past collaboration with NCDC on composting, which did not progress beyond initial stages.
- Highlighted the need for an MOA/MOU to formalize collaboration.
- NCDC acknowledged BSF’s potential for organic waste management, given the city’s high municipal waste output.
- Clarified NCDC’s role in supporting other municipal waste management programs in Lae, Alotau, Rabaul, and Goroka.

Key Discussion Points

Municipal Waste Overview

- NCDC collects ~30 tons of municipal waste daily from households and private companies.
- Waste composition: plastics, metals, and cardboard dominate; organics make up less than one-third of total waste.
- Organic waste composition varies by socioeconomic status; affluent areas discard more organic waste, while lower-income households reuse food scraps for composting or animal feed.
- Identified market waste as a potential starting point for organic waste separation, given its daily production of ~223.5 tons, one-third of which is organic.

Waste Separation & Management Initiatives

- Discussed strategies for source separation in NCDC’s long-term waste management plans.
- NCDC is considering a pilot project for organic waste bin collection at selected sites but requires funding under their Reduce, Reuse, Recycle (RRR) initiative.
- Awareness and educational programs were proposed to encourage recycling and waste segregation.

Baruni Landfill & Organic Waste Processing

- Daily waste disposal at Baruni landfill is ~202 tons, with a third being organic waste from public places, schools, and markets.
- JICA-funded semi-aerobic landfill system (four ‘cells’) integrates aerobic and anaerobic processes for waste decomposition.
- NCDC trialing market waste decomposition using fill rows; materials are highly fibrous and may require mechanical breakdown and nitrogen additives (e.g., manure) to enhance decomposition.

Opportunities for BSF Integration

- Potential to establish a BSF facility at Baruni to process organic waste on-site.
- Observed informal waste sorting by “pickers” (mostly women and young girls) collecting recyclables; a structured system could incentivize organic waste segregation and create employment opportunities.
- BSF farming presents a revenue stream for NCDC through larvae production (for feed) and frass fertilizer.
- A “work where the waste is” approach could optimize waste utilization and streamline municipal waste processing.
- Further assessments needed to quantify organic waste volumes and align BSF integration with Baruni’s semi-aerobic system.

Next Steps

- Formalize collaboration through an MOA/MOU.
- Conduct feasibility assessments for BSF facility establishment.
- Explore funding opportunities for organic waste separation pilot projects.
- Develop public awareness campaigns on waste management and recycling.
- Evaluate Baruni’s waste decomposition trials and identify improvement strategies.

A strong foundation for collaboration between NCDC and NARI, with BSF technology presenting a viable waste management solution. Further assessments, formal agreements, and pilot initiatives will be critical next steps toward possible partnerships with NCDC for implementation.



Plastic containers being collected



Composting of market waste being trialled



Pickers mostly female folk



High fibrous waste substrate



Recyclable metal, tin and bottle selling point



delivering sheep & goat manure bags for compost mixing



Group photo of NCDC waste management team and BSF NARI/PNGUoT team in Port Moresby after discussions on potential collaborations and partnerships.

B. NFA – Wednesday 14th of January 2025, 10:00am

Objective: Discuss the potential integration of BSFL as a sustainable protein source for aquaculture and explore collaborative opportunities with NFA and its aquaculture unit for farming BSFL as a protein feed source for inland pond farming.

Key Discussion Points

1. By-Catch & Fishery Waste Utilization

- The team explored the feasibility of using by-catch, fish processing offal, and related waste streams as feed substrates for BSFL.
- Recognized the opportunity to repurpose fish waste into high-value protein for aquafeed, reducing environmental impact.
- Emphasized the need for a structured assessment of available fishery waste and logistical considerations for collection and processing.

2. Survey Data on Fish Farmers

- NFA acknowledged the importance of understanding fish farmers' perceptions of BSFL as a feed alternative.
- Plans were discussed to conduct interviews and surveys to assess farmers' acceptance, cost considerations, and willingness to adopt BSFL-based diets.
- Identified the need for outreach and education to address potential knowledge gaps regarding insect-based feeds.

3. External Stakeholder Engagement

- Recognized the importance of engaging key stakeholders, including government agencies, private sector players, and research institutions, to support BSFL initiatives.
- Discussed opportunities for partnerships in research, training, and policy development to enhance BSFL adoption in the aquaculture sector.

4. Performance Testing of Imported Feeds

- NFA shared insights on the performance of imported aquafeeds from Vietnam and Thailand.
- Discussed the need for comparative trials to assess how these feeds perform against locally available and BSFL-formulated feeds.

- Considered integrating BSFL as a complementary or substitute ingredient in feed formulations.

5. BSFL-Formulated Diet Trials

- Explored the possibility of testing BSFL-based diets in open pond systems, as suggested by Joshua Noiney
- Discussed experimental design, key performance indicators (growth rates, feed conversion efficiency), and site selection for trials.
- Identified the need for collaboration with fish farmers and hatcheries to facilitate trials under practical farm conditions.

Next Steps

1. **Experimental Trials:** Conduct research to evaluate the efficacy of BSFL-based feeds and compared to the new Farmset fish feed and imported feeds.
2. **Fish Farmer Interviews:** Develop and implement a survey to gather data on farmers' perceptions and potential adoption of BSFL as a feed source.
3. **By-Catch Waste Management:** Assess the volume, logistics, and economic feasibility of utilizing by-catch and fish waste for BSFL production.
4. **Seminar on BSFL R&D:** Organize a presentation on BSFL research progress, findings, and its potential applications in aquaculture.
5. **Capacity Development:** Explore training opportunities in insect rearing techniques, aligned with the ACIAR SRA on BSFL in partnership with ICIPE.
6. **Regional Collaboration:** Align efforts with the broader ACIAR regional project under formulation to strengthen research and policy support for BSFL.

FISH FEEDS
KEY FEATURES *CARP & TILAPIA*

Advance Nutritional Formula
A high-protein diet for promoting growth, health, and immune support with essential Amino acids, vitamins, and minerals.

Superior Digestibility
Easily absorbed with minimal waste, promoting water quality and reducing the risk of contamination and Algae blooms.

Eco-Friendly & Sustainable
Locally made in PNG, available to local fish farmers, with responsibly sourced ingredients from both local and international suppliers. Design for low environment impact supporting sustainable aquaculture.

High-Quality Packaging
Sealed for freshness and nutrient preservation, available in 40KG, 20KG, 10KG and 5KG sizes for different operation scales.

Ideal for Bottom-Fed Species
A diet design for Catfish, Tilapia and Carp that stays after sinking.

Promotes Rapid Growth & Healthy Development
Ideal for all life stages-Starter, Grower, and Finisher-supporting optimal weight gain and feed conversion ratio (FRC)

High Stability
Resistant to quick dissolution, reducing feed wastage and ensuring long-lasting nutrient release for sustained growth.

Attractive to Fish
Formulated with natural attractants to enhance palatability and increase feeding rates.

FARMSET
NAMA QUALITY STOCKFEED
COMMERCIAL FISH FEEDS 40KG

FEEDING GUIDE

COMMERCIAL FISH FEEDS	FISH SIZE	FEEDING RATE (% OF BODY WEIGHT)	FEEDING FREQUENCY
Fish Starter	5 - 80 grams	7-8	3-4/day
Fish Grower	80 - 150 grams	4-5	3/day
Fish Finisher	150 up	2-3	3/day

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Advertisement image of a newly developed fish feed supplied by Farmset Limited supported by NFA; Group photo's including meeting presentations with NFA and BSF NARI/PNGUoT team in Port Moresby.

C. NISIT - Wednesday 15th of January 2025, 2:00pm

Objective: Discuss the potential BSF as a sustainable protein source for aquaculture and poultry in relation to standards and practices for new technology development.

Introduction & Project Overview

Met with representatives from NISIT to discuss BSF technology and its application as a bio-converter of organic waste. Presented an overview of BSF farming, including its role in food

waste management, livestock manure processing, and its implications for animal feed and fertilizer production in PNG. Highlighted successful models from East Africa where BSF has been industrialized at various scales. NISIT emphasized the need for standards that are adapted to the PNG context and recommended submitting a formal proposal through their framework. Proposal requirements include defining production methods, workplace safety, health and sanitation procedures, and quality control measures. NARI must provide chemical and biological data from research to support the standardization process.

Key Discussion Points

1. BSF Technology & Potential Products

- BSFL as a high-protein feed source for poultry, aquaculture, and livestock.
- BSF frass as a nutrient-rich organic fertilizer to enhance soil health and crop productivity.
- Waste bioconversion to reduce landfill waste and improve environmental sustainability.
- Shared documents from ISO, Codex Alimentarius on animal feed, and KEBS (Kenya Bureau of Standards) as reference points for standard practices in insect-derived feed and food products.

2. Standardization & Regulatory Considerations

- **Production Methods:** Establishing standardized protocols for BSFL rearing, waste processing, and product handling.
- **Health & Hygiene Compliance:** Setting safety measures to prevent contamination in BSF-derived feed and fertilizer.
- **Environmental & Workplace Safety:** Ensuring occupational safety guidelines for workers handling organic waste.
- **Chemical & Biological Standards:** Research-backed validation of BSFL composition, heavy metal content, and microbiological safety.
- **Fertilizer Use Standards:** Aligning BSF frass application with ISO/TC 134 standards on fertilizers and soil conditioners.

3. Risk Assessment: Handling Manure & Public Health Implications

- **Potential Pathogens in Agro-industrial or livestock wastes:**
 - ✓ *Escherichia coli*, *Salmonella spp.*, *Clostridium perfringens* (bacterial risks).
 - ✓ *Newcastle Disease Virus*, *Avian Influenza* (viral risks from poultry manure).
 - ✓ *Cryptosporidium*, *Giardia*, *Ascaris spp.* (parasitic risks in untreated manure).
- **Cross-Contamination Risks:**
 - ✓ Pathogen transfer into BSFL-derived feed products if manure is not properly treated.
 - ✓ Microbial contamination of BSF frass when used as fertilizer.
- **Mitigation Strategies:**
 - ✓ Pre-treatment of manure (composting, heat treatment) to reduce microbial load.
 - ✓ Routine safety assessments and microbial testing of BSFL products.
 - ✓ Compliance with ISO 22005 (Feed & Food Traceability) to ensure proper documentation and quality control.

Next Steps & Action Items

- **Proposal Submission to NISIT:**
 - ✓ NARI to draft and submit a formal proposal outlining BSF production standards, safety measures, and regulatory considerations.
 - ✓ Inclusion of chemical and microbiological research data to support approval.
- **Pilot Compliance Trials:**
 - ✓ Conduct controlled BSF farming trials adhering to proposed standards.
 - ✓ Evaluate the impact of manure treatment on pathogen reduction.
- **Stakeholder Collaboration:**

- ✓ Engage government agencies, private sector partners, and research institutions to validate and implement proposed standards.
- **Capacity Building & Public Awareness:**
 - ✓ Develop training programs on BSF safety, quality control, and sustainable farming practices.
 - ✓ Educate farmers and agribusinesses on the benefits and proper use of BSF-based feed and fertilizer.



Introduction and project overview by the BSF team and a group photo of NISIT team and BSF NARI/PNGUoT team in Port Moresby after discussions on standards on developing insect larvae-frass fertilizer production and appropriate use.

Documents shared by NISIT on the Codex Alimentarius and ISO as reference points for developing operational procedures for using insect larvae processed as feed for animals and insect frass fertilizer for soil conditioning.



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Form A.1: PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

Date of proposal: 20th May 2024

Reference number (to be given by secretariat): _____

Proposer (proposal to be completed by proposer): Max Kadoku - CHSC Secretary

Subject: Adopt Globally Harmonized System of Classification and Labeling of Chemicals as a PNG National Standard

Scope:

Addresses classification of chemicals by types of hazards and proposes harmonized hazard communication elements, including labels and safety data sheets. It aims at ensuring that information on physical hazards and toxicity from chemicals be available in order to enhance the protection of human health and the environment during the handling, transport and use of this chemicals.

Purpose and justification:

The GHS is an internationally recognized system for hazard classification and communication and classifies substances by physical, health and environmental hazards that they pose, and provides signals, hazard statements and standard pictograms to indicate the hazards and their severity.

Programme of work: Initial desk review to be conducted by the secretary with the help of the CHSC parent committee members. A working draft will be adopted for review for modification or full adoption of the GHS. The project is to be completed within two years from date of approval.

Liaison organisations:

1. PUMA Energy PNG Ltd

Form A.1: PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

Date of proposal: _____

Reference number (to be given by secretariat): _____

Proposer (proposal to be completed by proposer): _____

Subject: _____

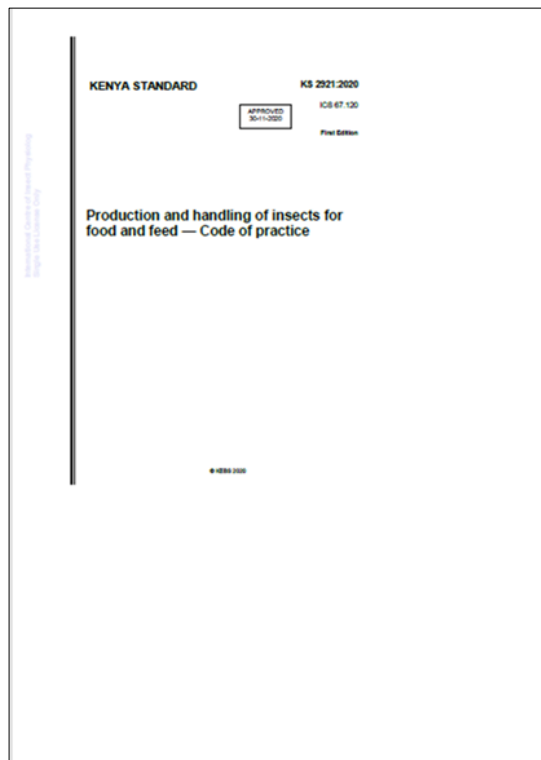
Scope: _____

Purpose and justification: _____

Programme of work: _____

Liaison organisations: _____

Proposal documents shared by NISIT (on file) on new field of technical activity with an example of a field template, to be submitted to the standards committee aligned to recommendations mentioned in the discussions.



Copies of Kenyan Bureau of Standards (KEBS, on file) to be used as the development framework of the proposed submission to NISIT.

D. RADHO PIGGERY - Thursday 16th of January 2025, 11:00am

Objective: Explore the feasibility of integrating BSF technology for pig manure and organic waste management, assess feed supply challenges, and evaluate production efficiency constraints.

Introduction & Project Overview

Meeting Summary with Radho Piggery on Black Soldier Fly (BSF) Waste Management & Feed Production. The meeting with Radho Piggery highlighted critical operational challenges related to feed costs, freight expenses, and underutilized production capacity. The farm produces 99 tons of pig manure monthly, presenting an opportunity for BSF farming as a sustainable waste management and feed production solution. Moving forward, structured feasibility assessments and technical engagement will be essential to determine the viability of BSF farming for Radho Piggery.

Key Discussion Points

1. Overview of Radho Piggery Operations

- Established in 1990, Radho Piggery is a large-scale pig farming operation located at 14 Mile, Port Moresby.
- **Current Livestock Population:**
 - ✓ 450 sows with a total herd of 4,321 pigs (operating at half capacity).
- **Feed Requirements & Costs:**
 - ✓ The farm consumes 140 tons of feed per month, valued at approximately PGK 350,000.
- **Production Output Estimates:**
 - ✓ Based on an estimated Feed Conversion Ratio (FCR) of 2.5 (best) to 3.5 (least efficient), the farm has the potential to produce 40 to 56 tons of pork per month with a 70% carcass yield.
- **Current Production Constraints:**
 - ✓ Operating at 50% of full capacity due to high freight and feed costs from Lae to Port Moresby.
 - ✓ Imported pork impacts local market competition, forcing local producers to reduce operating costs to maintain market stability.
 - ✓ The PGK 3.1 million butchery is also operating at half capacity, contributing to additional operational expenses.

2. Feed Supply Constraints & Grain Production Potential

- Feed Composition:
 - ✓ Corn makes up ~70% of the pig feed formulation.
 - ✓ Discussions included the feasibility of local grain production to reduce dependency on imported feed ingredients.
- Radho's Position:
 - ✓ While grain production is an option, Radho remains reliant on commercial feed manufacturers to maintain consistent feed supply and production cycles.

3. Pig Manure Production & Waste Management Feasibility

- Estimated Manure Output:
 - ✓ The farm produces approximately 99 tons of pig manure per month, based on a feed-to-manure conversion rate of 55%–80%.
 - ✓ Feed intake estimates range from 6%–8% of body weight, considering different growth stages (sows, piglets, weaners, growers, finishers).
- Current Waste Handling System:
 - ✓ Sump dimensions: 400 m² (10m x 8m x 5m).
 - ✓ Holding capacity: 1 m² per ton of waste produced.
 - ✓ Observations suggest improvements are needed in waste treatment and discharge management.
- Environmental Concerns:
 - ✓ Discussions focused on proper manure discharge into waterways, with an emphasis on developing a structured waste management system to reduce pollution risks.

4. Potential for BSF Farming as a Waste Management & Feed Solution

- **BSF Production Estimates from Pig Manure:**
 - ✓ Potential BSFL Output: 9.9 to 22 tons of larvae per month, based on BSFL conversion rates of 10%–22% of total manure volume.
 - ✓ Frass Production: 22 to 37 tons per month, providing a valuable organic fertilizer source.
- **Additional Waste Streams Considered for BSF Farming:**
 - ✓ Pig manure as a primary feedstock for BSFL production.
 - ✓ Butchery offal as a potential secondary waste stream for BSF rearing.
- **BSF as a Dual-Purpose Solution:**
 - ✓ **Waste Management Benefits:** Reduces waste accumulation and minimizes environmental impact.
 - ✓ **Feed Production Benefits:** BSFL could serve as a supplementary protein feed for pigs, potentially reducing reliance on expensive imported protein sources.
- **Need for BSF Technology Introduction:**
 - ✓ Observations suggested that a proper introduction to BSF technology would have enhanced discussions and allowed deeper exploration of waste utilization opportunities.
 - ✓ Future engagements should include detailed presentations on BSF farming models and economic feasibility.



Farm visit to Radho piggery with Manager, Mr. Mathew Kunba with pictures showing a group photo in front of the farm and manure sump pond.

Next Steps & Action Items

1. **Technical Presentation on BSF Integration:**
 - ✓ Organize a follow-up meeting with Radho Piggery to provide in-depth training on BSF technology, farming models, and cost implications.
2. **Feasibility Study on BSF Farming for Manure Management:**
 - ✓ Possible location to conduct small-scale BSF trials at Radho to assess larval production efficiency and manure conversion rates.
3. **Nutritional & Economic Analysis of BSFL as a Feed Component:**
 - ✓ Evaluate BSFL's suitability as a supplementary protein source for pig feed.
 - ✓ Conduct a cost-benefit analysis comparing BSFL production with imported protein feeds.

	<p>4. Waste Handling & Regulatory Considerations:</p> <ul style="list-style-type: none"> ✓ Assess potential biosecurity risks in handling livestock manure for BSF rearing. ✓ Explore regulatory compliance requirements for BSF-derived animal feed and fertilizer use. <p>5. Exploring Butchery Offal as an Additional BSF Feedstock:</p> <ul style="list-style-type: none"> ✓ Investigate processing and handling methods to use butchery waste efficiently in BSF farming.
	<p>E. 14 MILE LIVESTOCK FARM - Thursday 16th of January 2025, 3:00pm</p> <p>Introduction & Project Overview</p> <p>The meeting with 14 Mile Agro Farm Limited highlighted strong potential for BSF farming integration. With 15.6–22 tonnes of organic waste available per month, the farm could convert waste into 1.5–4.4 tonnes of larvae and 4.5–8.8 tonnes of frass, offering dual benefits for livestock feed and organic fertilizer production. Moving forward, structured training, pilot trials, and an economic feasibility study will be essential to assess BSF’s full impact on farm sustainability and profitability.</p> <p>Objective: Assess the feasibility of integrating BSF farming for organic waste management and sustainable feed and fertilizer production.</p> <p>Key Discussion Points</p> <p>1. Overview of 14 Mile Agro Farm Operations</p> <ul style="list-style-type: none"> • Ownership & Establishment: <ul style="list-style-type: none"> ✓ 14 Mile Agro Farm Limited is owned by Monica Kaupa, a local Papua New Guinean and former environmental lawyer. ✓ The farm was established in 2021 as a family business to provide income and support the local community. • Farm Composition: <ul style="list-style-type: none"> ✓ Livestock: 200 pigs and 150 broiler chickens. ✓ Horticulture: Three hectares of Lady Red pawpaw under cultivation. ✓ Labor Force: Eight full-time employees and additional support from church groups and rugby teams that weed the farm twice a week as a fundraising initiative. • Market & Sales Challenges: <ul style="list-style-type: none"> ✓ Pawpaw and chickens are sold at Port Moresby’s Gordons Market, while pigs are sold directly from the farm. ✓ Challenges include: <ul style="list-style-type: none"> ▪ High stock feed costs. ▪ Weather variability affecting horticultural output. ▪ Limited customer base, impacting sales volume. • Expansion Goals: <ul style="list-style-type: none"> ✓ Monica aims to diversify income streams by supplying large catering companies and supporting other farms. ✓ She is passionate about changing urban mindsets towards farming, advocating that agriculture is a viable and honorable livelihood. <p>2. Waste Generation & BSF Farming Feasibility</p> <p>The farm generates a significant amount of organic waste, providing an opportunity to implement a BSF farming system.</p> <p>A. Pig Manure Production</p> <ul style="list-style-type: none"> • Each pig produces 2.5–3.5 kg of manure per day • 200 pigs generate: <ul style="list-style-type: none"> ○ 500–700 kg of manure per day. ○ 15–21 tonnes of manure per month. <p>B. Chicken Manure Production</p> <ul style="list-style-type: none"> • Each broiler chicken produces 0.08–0.12 kg of manure per day

- 150 broiler chickens generate:
 - 12–18 kg of manure per day.
 - 360–540 kg of manure per month.

C. Pawpaw & Other Organic Waste

- Fruit farms generate 5–10% waste from damaged or unsold produce.
- If the three-hectare pawpaw plantation produces 5 tonnes of fruit per month, estimated waste loss is 250–500 kg per month.

3. Potential BSF Farming Outputs

- BSF larvae and frass production estimates based on waste availability:
 - ✓ Total organic waste available: 15.6–22 tonnes per month (from pig, chicken, and fruit waste).
 - ✓ BSF larvae production potential: 1.5–4.4 tonnes per month, based on 10–20% conversion rates.
 - ✓ BSF frass (organic fertilizer) production: 4.5–8.8 tonnes per month.

A. BSF Larvae as a Feed Source

- ✓ Protein-rich larvae could serve as a supplementary feed for both pigs and chickens, reducing dependence on costly commercial stockfeed.
- ✓ By integrating BSFL into feeding programs, 14 Mile Agro Farm could:
 - Lower feeding costs.
 - Improve livestock growth rates with a sustainable protein source.

B. BSF Frass as Organic Fertilizer


- The estimated 4.5–8.8 tonnes of frass per month could enhance soil fertility and reduce reliance on synthetic fertilizers.
- This aligns with Monica’s horticultural operations, providing an on-farm, cost-effective nutrient recycling system.



Farm visit to 14mile pig, chicken and horticultural farm for potential BSF farming on-site

4. Next Steps & Action Items

1. **BSF System Setup & Training**
 - ✓ Conduct a technical introduction to BSF farming for Monica and her team.
 - ✓ Identify suitable BSF rearing sites within the farm.
2. **Pilot BSF Farming for Feed & Fertilizer**
 - ✓ Implement a small-scale BSF trial, monitoring:
 - Waste conversion efficiency.

	<ul style="list-style-type: none"> ▪ Larvae yield per unit of waste. ▪ Frass nutrient composition for soil application. <p>3. Economic Feasibility Study</p> <ul style="list-style-type: none"> ✓ Conduct a cost-benefit analysis to assess how BSFL can offset commercial feed costs. ✓ Evaluate potential revenue streams from surplus BSFL or frass sales. <p>4. Scaling Up & Market Integration</p> <ul style="list-style-type: none"> ✓ Explore partnerships with catering companies to increase product demand. ✓ Consider collaborations with other farms to supply BSF larvae or frass.
5. Survey interviews	 <p>Individual poultry farmer interviews for the WTP survey for BSFL insect-based feeds for poultry.</p>
6. Follow-up actions required	<p>1. Potential Collaborations and Agreements</p> <ul style="list-style-type: none"> • Continued discussions with key stakeholders (NCDC, NFA, NISIT, NDAL and private farms) for potential partnerships for BSF farming initiatives. • Potentially have an MOA/MOU with NCDC for a BSF waste management facility at Baruni landfill. • Engage with NFA for BSFL feed trials and regulatory support. • Submit a formal BSF production standards proposal to NISIT. <p>2. Conduct Feasibility Assessments and Pilot Projects</p> <ul style="list-style-type: none"> • BSFL Waste Management: Assess organic waste volumes and feasibility of BSFL integration at Baruni landfill and partner farms (Radho Piggery, 14 Mile Agro Farm). • Aquaculture Feeds: Evaluate by-catch and fish waste suitability for BSFL feed production. • Livestock Feed Trials: Implement BSFL-based feed trials for poultry. • Economic Viability: Conduct cost-benefit analyses for BSFL production as a feed and fertilizer source. <p>3. Research and Standardization</p> <ul style="list-style-type: none"> • Gather and analyze data on BSFL feed conversion efficiency and nutritional value for livestock and aquaculture. • Develop safety and hygiene protocols for BSFL rearing and processing. • Collaborate with NISIT to set national standards for BSFL feed and frass fertilizer. • Conduct pathogen risk assessments and implement biosecurity measures.

	<p>4. Stakeholder Engagement and Follow-ups</p> <ul style="list-style-type: none"> • Schedule follow-up meetings with stakeholders (NCDC, NFA, NISIT, private farms) to discuss implementation strategies. • Provide technical backstopping on BSFL farming to Radho Piggery and 14 Mile Agro Farm. • Establish communication channels for continuous engagement and information sharing.
7. Other Comments	Several known sites could have been visited for the WTP and waste mapping surveys. However, due to time constraints, prioritizing partnerships with key public and private organizations was essential. Despite this, we successfully engaged a limited number of participants in both surveys, providing valuable insights into their structure and effectiveness as a trial. This experience will guide a more refined and comprehensive approach for the next round of surveys in Lae and Rabaul.
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