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Australian Centre for International Agricultural Research

Final report

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- The Betano Research Team (Jorge Amaral and Marcos Vidal) for their co-operation and patience in carrying out the tasks and methodology for NOT.

List of acronyms:

SRA: Small Research Activity

SoP: Stages of Progress

JICA: Japan International Co-operation Agency

DFAT: Australian Department of Foreign Affairs and Trade

TOMAK: To-os Moris Diak, a DFAT Timor-Leste agriculture development project

UNTL: University of Timor Leste

NTT: Nusa Tengara Timor, Indonesia

LP: Labour productivity

MALFF: Timor-Leste Ministry of Agriculture, Livestock, Fisheries and Forestry

IPB: Institut Polytechnic Betano

PVS: Participatory variety selection

RRA: Rapid rural appraisal

FGD: Focus group discussion

NGO: Non-government organisation

MDF: Market Development Facility, a DFAT-sponsored program

2 Executive summary

This SRA project forms the first stage of a planned larger scale project to improve smallholder farm and livelihood productivity with a focus on innovation in soils management and improvement. It has two broad aims: (1) To investigate and document the resource base, livelihood and agronomic strategies of communities in three distinct livelihood zones in preparation for implementing the Stages of Progress (SoP) methodology in 3x2 sets of villages. The 3 proposed livelihood zones comprise: 1) Inland irrigable watersheds, 2) Upland high altitude, 3) Southern rainfed. (2) Contract and train a small team of Timorese project staff including local NGO partners in the Stages of Progress (SoP) methodology and associated qualitative research.

The process started by selecting TL leader remotely to initiate activities, followed by establishing selection criteria for choosing the three livelihood zones for the study location including some consultation with relevant stakeholders. This step selected three municipalities (Ainaro, Baucau and Manufahi) representing the three livelihood zones. Further guidance from data of livelihood zones characterisation done by Williams et. al. had narrowed down list of several villages to be decided together with the local leaders and the SoP team. With the limited availability of local NGOs in each municipality and intention of establishing partnership with Universidade Nasional Timor-Lorosa'e (UNTL), the SoP process was decided to carry out by the UNTL research team. Prior to that, a training on SoP was held on the 23rd to 24th August, 2022 by Dr. Andrew McWilliam, participating by one AiCom staff, 2 staff of the National Directorate of Research of MAF, 2 staff from TOMAK (To'os ba Moris Diak/Farming for Prosperity, a DFAT funded Agriculture Project), 3 UNTL research team and 5 final year UNTL students. An agreement was then processed to commission the UNTL research team. With the timely execution of activities and well-coordinated process that the UNTL team had established, additional survey on food security and sovereignty was added to the agreement to be carried out by the UNTL team. The SoP process had selected the pairs of hamlet in each municipality, Bee Metan and Loro, two hamlets from suku Betano of Same post-administrative of Manufahi municipality; Raebuti-udo, a hamlet from suku Manutasi of Ainaro vila post administrative of Ainaro municipality; Gorema, a hamlet from suku Horaiquik of Maubisse post administrative of Ainaro municipality; Caihula, a hamlet of suku Uma-Ana-Ulo of Venilale post administrative of Baucau municipality; and Saraida, a hamlet of suku Baguia of Quelicai post administrative of Baucau municipality.

Results highlights:

- Final report of the **Stages of progress (SoP)** had yielded a pertinent information to form research questions. The result was also presented through a showcase event of the Timor-Leste Australia Alumni Association (TL3A) participating by various stakeholders including MALFF social science researchers, TOMAK, AiCom, Ministry of Solidarity, Social and Inclusion, local NGOs. The SoP covered 4 main questionnaires, where three were for SoP and one for food security and sovereignty survey. The key results were:
  - Local communities differ in their notions and perceptions of poverty from region to region and community to community.
  - In order to address poverty issues locally, it is essential to comprehend the concept and characteristics of poor rural households from the community's perspective.
  - Due to a variety of factors, including geography, the development of basic infrastructure, the variation in job opportunities, social and economic factors, poverty is distributed unevenly among the areas and communities.
  - There was a wide range between locations of the proportion of households making income from agriculture, from 93% at Gourema to 20% at Saraida.

- There was a range between locations in the use of fertilizers and pesticides, and purchase of seed.
- Rural poor families rely mostly on the agriculture sector for their living, with minimal variation in their source of income.
- Families that have escaped or remain out of poverty have a greater current diversity of income sources
- Earning more income currently from vegetable sales and livestock sales correlates with escaping or remaining out of poverty
- Currently owning or having access to a 2-wheel tractor correlates with escaping or remaining out of poverty
- The creation of new work opportunities in rural areas and/or an increase in agricultural productivity can improve the quality of life for rural poor households.

Following the SoP process, an adapted **Rapid Rural Appraisal (RRA)** process, and consequent participatory research question selection process, was conducted by SRA team consisted of Leigh Vial, Marcia e Silva, with the assistance of two UNTL socio-economic final year students, Jaime da Silva and Elivania Correia. This process is carried out in each selected hamlet. The objective of the RRA was to understand the characteristics, current agriculture system and assets of the selected community, including the problems and opportunities for interventions. The result of this was a well-documented site characterisation/profile of each hamlet.

- A **desktop review** was done on recent projects and work of research and development partners and initiatives in Timor-Leste that have been done in or near the selected sites (Annex 3).

- To guide a better understanding of the soil nutrition status and in the effort of establishing a research question related to soil nutrition, a variation was added to carry out **Nutrient Omission Trial (NOT)** and fertilizer rate trials in the six locations selected. Hence, UNTL team were commissioned to conduct NOT as part of the UNTL final year agronomy student's requirement. Partnership with TOMAK benefited the SRA by expanding the geographical areas of the NOT. Partnership with Betano Research Center yielded a well-defined protocol for NOT. As a result, 12 nutrient omission trials and 6 rate trials were conducted in (Ainaro, Baucau, Bobonaro, Hera, Manufahi and Viqueque).

  Almost all locations had a nitrogen response, 9 of the 11 locations had a sulphur response (plus Betano Research Centre which only had an early sulphur response), 4 locations had a phosphorus response, 4 locations had a potassium response and 2 locations had a zinc response.

  The UNTL rate trials generally showed a 13-46 per cent yield response to the low rate of 20 kgN per hectare, 4 kgP, 8 kgK, 4 kgS and 0.2 kgZn per hectare (Table 6.2). The response to the high rate of 100 kgN, 40 kgP, 80kgK, 40 kgS and 2.0 kgZn per hectare was 43-151 per cent.

- From the result of the SoP, RRA and desktop review a set of research questions were drawn. These research questions were presented to the community as a **participatory research question selection**. Although the process was not able to shorten the research questions list, but clearer activities for larger project were obtained. As a result, a set of research questions were defined for each location. The overarching objective of the vast bulk of the research questions is increasing labour productivity; all communities expressed that labour supply for on-farm activities is very limited,

especially at peak demand periods. Several other projects in Timor-Leste (e.g. AI-Com, JICA) report the same thing.

The common research questions were:
- What is the most limiting nutrient(s) in current on-farm systems?
- What is the yield response to adding the most limiting nutrient(s)?
- What is farmers' assessment of micro-dosing? Does micro-dosing of most limiting nutrient offer sufficient benefit for adoption by the locations farmers?
- What type of mechanization would best fit and increase labour productivity?

The location specific questions were:
- What is the yield of current improved rice varieties and how does adding the limiting nutrient affect grain yield? (Saraida, Caihula, Raebuti Udo)
- What weed management options exist and what is their effect on labour productivity? (Caihula, Saraida, Gorema)
- How can an improved in-situ grazing system be introduced for best effect? (Saraida, Caihula, Bee Metan and Loro)
- What is the effect on wet season and dry season vegetable production by using plastic tunnels? (Raebuti Udo)
- How can existing herbicides be safely used for efficacy and labour productivity? (Loro)

- **A simple, low-cost multi-crop drill seeder** was brought in from Thailand for trial with an objective to answer early on part of the research question in mechanisation, particularly in Betano where farmers are interested in mechanised seeding. This trial has been the foundation of establishing a partnership with Dom Bosco in terms of mechanisation modification, which will be done based on feedback from farmers and researchers during field trial. The seeder successfully seeded maize and mungbean, both in tilled soil and no-till. The seeder saved much labour compared to manual planting, notwithstanding it was on a research station where manual planting was particularly laborious.

- **A soil expertise/researcher from Kupang** was invited for a cross visit to Timor-Leste during the NOT field visit with the objective of establishing triangular cooperation.

In the subsequent larger project, the project team expect to continue the partnership with UNTL, MALFF through department of research and statistic and agriculture extension, Dom Bosco, TOMAK and potentially, which had been confirmed, with Institute Polytechnique Betano and 2 to 3 researchers from Kupang, Indonesia.

The challenges identified in these processes were more related to the coordination process with the community, local leaders, connectivity as well as road conditions at some hamlet, particularly Gorema. However, these challenges could be overcome with effective communication and planning. Some of the potential risks identified was on drill seeder; bringing in this mechanisation could be irrelevant in Timor context, given on-farm mechanisation is currently uncommon.

These SRA has successfully partnered with UNTL,TOMAK and MALFF for research capacity building, scaling up and adoption. A good collaborative culture has been established.

3 Background

Timor-Leste is one of the poorest nations in the world. Since Timor-Leste gained independence in 2002, there have been significant efforts and resources provided through Australia's ODA program along with investments from international development agencies, that aim to address the low agricultural productivity in the country and improve food and nutrition security for the population. However, progress towards these goals has been slow; indeed, staple food production has been declining (Inder, 2023). This SRA provides a stocktake of development efforts across the agricultural systems (crops, livestock, vegetables) within three key livelihood zones which have been identified by the TOMAK program of DFAT in TL. The SRA assesses the impacts and legacy of research and development initiatives within these livelihood zones, the resource base of farming households, the knowledge and recent successes of farmers, and their motivations in relation to agronomic decision-making, and the capacity and experience of government agencies and non-government organisations to both deliver and participate in applied research for development projects. This SRA provides knowledge on the cultural, socioeconomic, and the agronomic context and potentials of the target livelihood zones.

SRA project forms the first stage of a planned larger scale project to improve smallholder farm and livelihood productivity with an element of innovation in soils management and improvement. However, the SRA looks broadly at the current farming systems, including the social, cultural and agronomic influences on on-farm productivity and consequent household livelihood. From this, this SRA will define a set of research questions, locally defined in each of six locations, that aim to improve household livelihoods with on-farm innovation. This approach differs from developing common research questions in advance of engaging target communities.

4 Objectives

The objectives of this SRA are:

- Review on previous related projects in Timor-Leste
- Identify local partner organisations, research and otherwise
- Select and characterise six prospective research locations, inclusive of Stages of Progress
- Analysis of constraints and opportunities, leading to possible interventions, technologies and approaches
- Conduct and report nutrient omission (NOT) and rate trials

To guide the team in carrying out these tasks, the following activities were identified/conducted:

- Review selected regional and relevant research development literature on the results and recommendations of previous project interventions in Timor-Leste and West Timor.
- Identify, review and contract preferred local partner organisations and project research partners to facilitate project field surveys and project implementation.
- Identify the agricultural resource base and agronomic drivers and motivations, undertake food security and food sovereignty assessments, generate/assemble soil maps/agricultural system and calendars/seasonal market patterns for prospective research locations.
- Develop and trial the Stages of Progress (SoP) Survey forms, methodology and scope for analysis.
- Present an analysis of existing practices, constraints and opportunities that can inform the design and implementation of prospective interventions, technologies and approaches that are aligned with community interests.

Table 3.1 below has helped identify the risk of constrained or delayed accomplishment due to the remote nature of project management.

Table 3.1: The intended activities, actual implementation, who is responsible

Activity	Planned	Actual	Responsibility
Select TL Leader and 3 TL FCs	Selection using remote methodology	TL Leader was selected remotely. The 3 TL FCs was seen as not a priority, hence a national coordinator was hired instead.	AMcW LKV
Engage MAF and representative		Engaged through Nutrient Omission Trial in Betano Research Center	TL Leader LKV BRC
Select an NGO in each livelihood zone if applicable	There is some redundancy built in between the FCs and the NGOs, but deliberately so.	UNTL research team were the suitable partner to carry out the tasks.	TL Leader LKV

Preliminary location selection	6 villages (3 pairs) in 3 livelihood zones 1) *Inland irrigable watersheds* 2) *Upland high altitude*, and 3) *Southern Rainfed*	Completed as planned.	TL Leader LKV AMcW TOMAK AI-Com MAF Municipal/District Officers
Stages of Progress	Train TL staff in SoP Develop SoP survey forms and approach to implementation.	Trained UNTL research team	TL Leader AMcW MAF Municipal/District Officers NGO
Describe and document biophysical and socio-economic attributes, and assessment of food security and sovereignty, for each study location including soils, land use, crops, horticulture, livestock, water and forestry resources.	Detailed site descriptions and mapping 6 case study areas. Requires in-country (Dili and Kupang) co-operation to track down materials, support and undertake surveys, and develop and manage partnerships and relationships	Done as planned with an additional on variation to carry out NOT and through RRA instrument	LKV, MM, Jaime and Elivania (UNTL finalists) UNTL BRC National coordinator TOMAK
Review existing regional and relevant literature on the design, implementation, results and recommendations of previous research and research-for-development project interventions.	Evaluate what worked (structure, types of technology, engagement mechanisms). Evaluate the limitations of previous approaches (structure, engagement, types of technology, alignment with culture and policy, participatory-ness)	Done as planned	AMcW LKV TL Leader
Give consideration to prospective technologies, initiatives for adaptive implementation	On-farm technologies and techniques Improving links to markets and market information Other	A drill seeder as an early introduction to answer part of mechanization research question	TL Leader LKV Dom Bosco BRC

5 Methodology

This SRA has been planned and designed to be pursued remotely with online communication and reporting. However, with the COVID-19 travel restriction being lifted in 2021, regular visits and field work were possible to carry out. Successful selection of the in-country project staff comprising a Timorese Country Project Leader was done, and a national co-ordinator joint in at the later stage to support field work. Existing networks and relationships with ACIAR, DFAT, TOMAK, UNTL and MALFF in Timor-Leste were strengthen through NOT and SOP. Constant support from the new iteration of ACIAR AI-COM project team were obtained in terms of site selection, methodology discussion and some administration work.

Staff, partnership and location selection

- The selection of the Timor-Leste Country Project Leader for the SRA was done remotely. The Country Project Leader was then recruited a national coordinator to support overseeing field activities.
- With the limited availability of local NGOs in each municipality and intention of establishing partnership with Universidade Nasional Timor-Lorosa'e (UNTL), the SoP process was decided to carry out by the UNTL research team.
- The in-kind partnership with TOMAK was established with the purpose to conduct Nutrient Omission Trial at locations intersections with SRA, but also potential expansion of N.O.T to TOMAK's sites where SRA is not present.
- Partnership with MALFF through Betano Research Center was established for the purpose of scaling up and methodology refinement.
- Along the process, Dom Bosco was also selected to be a partner, particularly in the subsequent larger project, mainly to support mechanical work and some necessary training in mechanisation.
- The six SRA location were selected based on the three livelihood zones: inland irrigable watershed, upland high altitude, and southern rainfed. The process of selecting the location were as followed:
  - Selected municipalities were narrowed down based on data provided from the latest paper an approach to characterise agriculture livelihoods and livelihood zones using national census data in Timor-Leste (Williams et al., 2017).
  - The selection is also guided by certain criteria established, including: representative of large parts of Timor-Leste, particularly high population areas, as well as having potential for expanded agricultural and horticultural development; each location should have livestock (especially chickens, cattle, and pigs (depending on impact of African Swine Fever); one hour drive from the city center; not a project heavy area; have some appetite for innovation. Access to and utility of forestry resources were also considered in each of the selected locations.

Stages of Progress and attributes documentation

The Stages of Progress (SoP) survey instrument is a relatively simple participatory tool that engages local communities through samples of 40 representative households to explore poverty dynamics and articulate local concepts of poverty and prosperity at local levels (Krishna 2006: 271-88). Village focus groups rank all resident households against local concepts of poverty/prosperity and evaluate their fortunes over time vis-a-vis these standards. The methodology provides a basis for understanding pathways into and out of poverty on a household and gendered basis, and the strategic choices and constraints that have influenced householder economic status over time.

This SRA developed the Stages of Progress (SoP) survey design and methodology as it generated the principal attributes of each location and reviews relevant outcomes of previous projects. This preparatory had provided the basis for mobilizing a full ACIAR project to adaptively trial and implement the SoP and selected technologies and development initiatives. In the selection and trialling these initiatives several factors including policy settings, proven on-farm technologies, market access, supply and market chain information as well as strategic economic infrastructure and planning were considered.

The Stages of Progress methodology was adapted to the Timor-Leste context and tested in the 6 selected locations. Prior to the full implementation of the SoP, a training was delivered to the UNTL research team, including MALFF research department, AiCom, TOMAK and several socio-economic final year UNTL students. After the training and in preparation towards the SoP implementation, the following steps were taken:

- Established agreement with UNTL
- SoP survey form was adapted and purpose-built questionnaire were developed.
- Implementation of SoP on the ground
- Periodical meeting and team review
- Final questionnaires on food security and sovereignty conducted
- Final report presentation

Rapid Rural Appraisal (RRA)

The documentation of the biophysical and socio-economic attributes of each location was undertaken in parallel with the Stages of Progress. To understand further the social characteristics and site characterisation of the 6 locations, a simple version of rapid rural appraisal (RRA) was conducted. The methodology was adopted from TOMAK and was refined as deemed fit with the purpose. The RRA served as an instrument to direct the focused group discussion with the community of the selected locations. The tools used included: a summary map of community's location, seasonal calendar, tree problem, problems and opportunities table and open discussion. The result of the RRA, helped guide the formulation of research questions of each location and described the characteristic of each location (Annex 5). After the group discussion, a transect walk was conducted, at the same time collecting soil samples for some simple lab test (pH and texture).

Previous project review

A desktop study was undertaken by Andrew McWilliam and Leigh Vial, with local 'ground-truthing' and feedback from in-country project staff, focused on research-for-development projects and projects with a clear research link. Previous projects were reviewed and assessed in relation to their; objectives, methodologies (structure, engagement methods, technologies), outputs (planned and actual), outcomes (planned and actual) and recommendations. Previous project reporting were judged according to criteria of success/effectiveness, such as; demonstrated post-project success on a small or larger scale, suitability for the conditions, can be leveraged for relatively quick higher cash/food replacement returns, prospects for significant increase in labour productivity, supporting female farmers, and low cost/low risk investment inputs.

Selected previous projects were:

- Former ACIAR/ADB/World Bank Livestock projects (Cattle, Pigs and Poultry)

- Former ACIAR Seeds of Life project including post-project impact evaluation.

- World Bank's, Sustainable Agriculture Productivity Improvement Project in Timor-Leste[1]

- DFAT's recent TOMAK (Farming for Prosperity) initiative, including methodological approaches to implementation such as local partnering with NGO/CSO's

- MDF (Market Development Facility) (2020). Timor-Leste, DFAT Australian Aid.

- The System of the Rice Intensification (SRI) development program in TL (Nolze et al 2013, Nolze et al 2012.

- ADB Timor-Leste Coffee Industry Association Development & Tradewinds: https://www.tradewinds.org.au/timor-leste-medium-roast.

- Improving Livelihoods of Smallholder Coffee Communities in Papua New Guinea [ACIAR Project 2017-2021]

- JICA's Project for Community-Based Sustainable Natural Resource Management (CBNRM) Phase II / Community based Natural Resource Management (CBNRM) in Timor-Leste (various donors).

Variation

A variation was added during the process, i.e. conducting nutrient omission trial and trial of drill seeder with BRC. 12 NOTs were successfully conducted and drill seeder trial is expected to complete by early 2024.

Whilst conducting the SRA, CDU researchers and administrative staff were engaged when the project or Timor leader was on-campus. Marcia, Andrew and Leigh gave a seminar at CDU on the SRA methodology and preliminary findings.

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[1] https://projects.worldbank.org/en/projects-operations/project-detail/P155541?lang=zh

6 Achievements against activities and outputs/milestones

Objective 1: Review on previous related projects in Timor Leste

no.	activity	outputs/ milestones	completion date	comments
1.1	Review previous ACIAR projects			Complete. Summary in Section 7.
1.2	Review of other projects			Complete. Summary in Section 7.

PC = partner country, A = Australia

Objective 2: Identify local partner organisations, research and otherwise

no.	activity	outputs/ milestones	completion date	comments
2.1	Consider local public and NGO partners			
2.2	Choose partners for SoP	Research agreement established	September, 2022	UNTL chosen for SoP
2.3	Choose partners for other activities	Complete	December, 2023	UNTL, TOMAK and BRC chosen for NOT, Dom Bosco for mechanization work and for proposed project.

PC = partner country, A = Australia

Objectives 3 and 4: Select and characterise six prospective research locations, inclusive of Stages of Progress

no.	activity	outputs/ milestones	completion date	comments
2.1	Select livelihood zones	Livelihood zones selected	June 2022	Inland irrigable watersheds Upland high altitude Southern rainfed
2.2	Create SoP questionnaires	Questionnaires complete	October 2022	Included food security and dry season livelihoods survey
2.3	Choose sukus/aldeiaa	Chosen		Bee Metan, Loro, Raebuti Udo, Gorema, Saraida and Caihula.
2.4	Conduct SoP	SoP report	June 2023	Full report in Appendix 1.
2.5	Conduct food security assessment	Food security assessment report	October 2023	Full report in Appendix 3.
2.6	Conduct RRA	RRA complete	June 2023	Full report in Appendix 2.
2.7	Conduct participatory RQ selection	Research questions chosen	October 2023	A central theme of on-farm labour productivity. Research questions in full proposal for SLAM-2020-131

PC = partner country, A = Australia

Objective 4: Analysis of constraints and opportunities, leading to possible interventions, technologies and approaches

no.	activity	outputs/ milestones	completion date	comments
2.1	Consider results of SoP, RRA	Final report and summary of site characterisation	October 2023	Final result of SoP were presented in a Timor-Leste Australia Alumni Association (TL3A) show case event.
2.2	Conduct participatory RQ selection	Research questions chosen in each location	June 2023	Research questions for full proposal in Section 7.
2.3	Consider overarching themes and approaches	Combined/common research questions and approaches chosen in full proposal	October 2023	Research questions for full proposal in Section 7.

PC = partner country, A = Australia

Objective 5 (Variation): Conduct and report nutrient omission (NOT) and rate trials

no.	activity	outputs/ milestones	completion date	comments
2.1	Determine NOT protocol	NOT protocol (inc fertilizer formulae) for rice, maize and leafy vegetables	April 2023 (maize) July 2023 (rice and leafy vegetables)	NOT protocol developed.
2.2	Conduct BRC NOT	BRC NOT report	July 2023	A high CV limited the findings
2.3	Conduct 4 TOMAK NOTs	4 NOT reports to TOMAK	December 2023	Rice NOT unsuccessful, 3 NOT with leafy greens successful
2.4	Conduct 7 UNTL NOTs and 7 rate trials	Student seminars and reports	December 2023	Completed to a high standard. Presented in a day of seminars on December 11th, 2023.
2.5	Conduct mechanization trial with BRC	BRC report	April, 2024	Trial of the seeder commenced on December, 2023. Three plots for planting maize, mungbean and upland rice. Plot for maize will turn into NOT.

PC = partner country, A = Australia

7 Key results and discussion

Objective 1: Review of other related projects in Timor Leste

In summary, the findings of this investigation were:

Redi Komodi

- Cut-and-carry systems were technically better but generally incompatible with labour availability
- Neither uncontrolled, extensive grazing on unimproved forages, nor cut-and-carry provided an adequate return per day of labour.
- The improved cattle value chain, with payment on weight, has persisted post-project (good demand for beef in urban Timor Leste)
- The project successfully exposed farmers to improved forages
- Better cow and calf management increased income at a reasonable return per day
- Good training material developed that MAFF can use
- A good Leucaena field site still operating at IPB
- Cut-and-carry system gave about US$5/day, extensive grazing US$2.20/day, unimproved cow-calf system US$8.68/day, improved cow-calf system (more calving, less mortality, more growth) gave US$22/day

SRA LS/2017/035 Evaluating the opportunities for smallholder livestock keepers in Timor-Leste

- Livestock is of vital importance to households, both for ceremonial and cashflow needs. 87% of households kept livestock.
- Systemic and coordinated support for animal health and livestock sectors should continue. Mass mortalities from disease still occur.
  - *'Without systemic intervention and support for the animal health sector at a national level and across all municipalities, impactful and sustainable improvements to the system will be difficult to achieve'*
- Cattle production systems should orient to the domestic market for cattle, rather than export. This can be commercial supply to Dili or other centres, or especially ceremonial use.
- Pig Sector should be supported, but not with an orientation to supplying pork to Dili market. Localised supply, particularly for ceremonial purposes.

JICA

- Project sites were in two irrigation schemes, 1) Buluto Irrigation Scheme (Laleia in Manatuto and Vemasse in Baucau); 2) Maliana 1 irrigation scheme.
- The objective of the project was to increase farmers household income through the improvement of rice value-chain.
- There were 6 outputs related to rice farming activity, including rice farming, irrigation management, market (domestic distribution and government distribution), shared lesson learned and options to formulate domestic rice promotion policy.
- Based on study conducted by University of Tokyo in Maliana 1 irrigation scheme, out of 1020,5 Ha rice cultivation area, 591, 1 Ha used broadcasting system due to limited water availability. Hence, drum seeder and push weeder were introduced.

- Beneficiary farmers were shown to the proper cultivation system/management using drum seeder and push weeder through Farmers Field School.
- Results showed in demonstration plot that, direct seeding using drum seeder yielded higher than broadcasting, while there is no significant difference between direct seeding and transplanting although transplanting yielded slightly higher.
- Substantial yield increases were achieved with better weed control (land preparation, herbicides and mechanization: push weeder) and NPK fertilizer application.
- Farmer Field School participants had double rice yields of non-participants in Maliana, but similar yields in Laleia.
- Irrigation supply processes and institutions were strengthened, and some canals repaired.
- Some of the benefits highlighted with the introduction of drum seeder and proper weed management were low labour needed, higher yield, easy to manage, less seed used.
- While challenges: proper land preparation is needed to make sure seeds are grown. Frequent weed control is needed as water is less used.

AVANZA

- Six western municipalities
- Established a better vegetable value chain, with more growers, marketers and customers
    - Supplied inputs, some infrastructure and advice to improve vegetable production
    - Supplied finance with several providers; one in particular, Kaebauk Investimentu no Financas, S.A's, a local micro-finance institution was successful
    - Supported marketing businesses establish infrastructure and networks
- Seven new technologies
    - Improved seeds
    - Pest management
    - Irrigation
    - Cropping practices like plant spacing, trellising and tunnels
    - Post-harvest
    - Increasing soil fertility
    - Mechanization
    - Business training
- The strawberry value chain was successfully established, and has persisted post-project
- Several strawberry marketing businesses persist post-project
- Plastic tunnels, introduced for protected vegetable production, have persisted in some locations.
- Our RRA found consistent strong on-farm demand for vegetables in Ainaru, suggesting that AVANZA has had some persistent effects

LPS/2012/064 Integrating herbaceous forage legumes into crop and livestock systems in East Nusa Tenggara, Indonesia

- Neal Dalgleish was an important resource and mentor
- Clitoria ternatea was the most resilient and adaptable forage legume
- 'Lower-labour options can be used effectively without dramatically compromising productivity'.

- Grain yields after legumes were 50% higher if legumes cut and removed, and 90% higher where legume biomass was retained
- Legumes can also be grown in mixtures with low density maize crops with minimal risk of reducing grain yields.
- Even small amounts of legume reduced DS liveweight losses, reduced calf mortality, increased calf growth rates and increased cattle growth rates
- 'Where legumes have been trialled, we have seen reduced (cut-and-carry fodder) labour burden for women and labour inputs required were a clear driver for adoption'
- Labour for forage land preparation, establishment and weeding is a key constraint
- Forage seed production and distribution is a constraint
- More benefit is obtained where more land is available

FAO Conservation Agriculture, school feeding and two-wheel tractor project

- Targeted more than 3000 farmers across all municipalities
- Farmers in general spent so much time and money in weeding during growing maize, hence a package to introduce Lehe (velvet bean) for weed control is done. Lehe produces a lot of biomass to suppress the weeds and also conserve the moisture in the soil.
- Lehe is also successfully introduced as a viable means of fixing N in the system, but it tends to smother crops when inter-cropped, and seeding after lehe is problematic ('hard' soil, scorpions and rats in lehe mulch).
- The project has succeeded in introducing two-wheel tractors to target locations.
- Distributed 2-wheel tractor mostly in all targeted (10) municipalities, except Ermera. But the municipalities that adopted this technology mostly are Betano and Viqueque.
- Seed injector was introduced however was difficult to adopt particularly in hard soil and when planting in line. Oftentimes seed did not bury down the soil and no proper distancing.
- The next project phase is targeting farmers living close by schools to supply school feeding program.

AI-Com 1

- Low-labour mungbean, developed on farmer suggestion. This returned about US$15/day of labour
- Large yield response found to biochar and biochar+ (rice, vegetables, legumes)
- Large response found to NPK in rice at Vermasse.
  - 125 kgN/ha increased GY from 0.8 t/ha to 5.9 t/ha
  - 50 kgP/ha increased GY from 1.9 to 4.0 t/ha
  - Biochar at X t/ha increased GY another 1 t/ha.
- Vegetable crops after rice +/- fertiliser
- Introduced new legume germplasm from CG centres (common bean, cowpea and pigeon pea)
- 10-13 UNTL final year students conducted rice research at Vermasse and Laleia over 4 seasons.

TOMAK2

- Bobonaro, Baucau and Viqueque

- Aiming to invigorate four agricultural value chains for increased annual returns to 14,000 households (onions/shallots, mung beans, peanuts and red rice)
- GAPs
- Understanding of nutrition and food security outcomes
- Improved livestock production, with partners
- Aiming to increase demand for year-round production and utilization of nutritious food, with objective targets
- Nutrition sensitive agriculture, including post-harvest storage
- Climate smart agriculture ('land and water management interventions') in all interventions, highlighted no-till system. A broad church with which to intersect.
- 'For instance, investments in varietal adaptation, crop/ enterprise diversification, and improved post-harvest management would all improve smallholder adaptation and resilience and complement more sustainable land and soil management.'
- 'Further collaboration with ACIAR's research programs could enable scale-out of productivity-enhancing varieties and technologies along with complementary improved land and water management systems.'
- Nutrient-rich crops like moringa, green leafy vegetables
- Build capacity of agricultural extension workers
- Improve input supply
- Improve market opportunities
- It is still quite open as to what can be done under NSA and CSA banners. The nutrient omission trials and the proposed micro-dosing trials fit well.
- Seeking government, NGO and private partners as needed…including ACIAR, and USAID
- Strong GEDSI component

TOMAK

- Target groups had greater production, diversity of production and crop sales, better crop storage.
- Target groups had changed knowledge of and attitudes to nutrition
- Objective nutrition measures were not affected much
- Savings and loan groups had most dietary diversity and food consumption scores of the groups
- Agriculture + nutrition + access to finance are key components in meeting TOMAK's broader outcomes
- Profit per hectare for shallots/ onions is extremely high (25,490USD/ha), followed by 2,497USD/ha for peanuts, 1,363USD/ha for mung beans and 762USD/ha for red rice.
- Expansion farmers followed more GAPs, received more extension and marketing support, were more confident about accessing inputs and experienced fewer 'constraints' in on-farm production.
- Expansion farmers had more crop sales than control group, and selling was generally quite easy. Collectors readily bought at farm gate.

Objective 2: Selection of partners

Partners were selected for the SRA, but also with a subsequent project in mind. Conduct of SRA activities was an opportunity to 'road-test' a possible longer-term partnership.

Our primary partner for the SRA was UNTL. First, they acted as consultants conducting the Stages of Progress (SoP), which allowed rapid design and execution of it. The subsequent partnership to conduct nutrient omission and rate trials was much closer to a desired longer-term partnership; engagement with the research questions, the design, execution and reporting

of it. The undergraduate students have conducted these trials very well in-situ at the six locations, producing quality results with the associated challenges of on-farm experiments.

A second partner was MALFF, in particular the Betano Research Centre (BRC) in Manufahi. BRC is very close to both of the SRA's Southern Rainfed locations, and has a history of collaboration with AI-Com. They conducted the first nutrient omission trial and a multi-crop seeding trial with the Thai drill seeder. They complement nearby on-farm work well.

A subsequent partner was TOMAK, the DFAT-funded agriculture development program. Mutual benefit was identified early in the SRA, then nutrient omission trials commissioned at four locations. A synergy has been found, where TOMAK staff oversee experiments chosen to benefit their program (in this case TOMAK's fertilizer program). TOMAK gains insights as to limiting nutrients at target locations, and our SRA gets exposure in alternative locations.

A final, minor partner for this SRA was Dom Bosco, a Catholic-based training institution that has long been in Timor Leste. They share a mutual interest in small mechanisation, so were quick to engage with us making small changes to the Thai drill seeder to service the target environment at Betano in particular.

Objectives 3 and 4: Select and characterise the six prospective locations, inclusive of the SoP.

The six selected locations were:
- Southern rainfed:
    - Aldeia Loro, Betano, Manufahi
    - Aldeia Bee Metan, Betano, Manufahi
- High altitude:
    - Aldeia Raebuti Udo, Manutasi, Ainaru
    - Aldeia Gorema, Maubisse, Ainaru
- Inland irrigable watersheds
    - Aldeia Saraida, Quelicai, Baucau
    - Aldeia Caihula, Vermasse, Baucau

The selection process was undertaken in concert with the Stages of Progress, after an initial survey of the area, considering selection criteria. In particular, the locations were paired; a convenient, better-serviced location and a poorer-access location.

The SoP report is in Appendix 1. In summary, the SoP found:

Many households in all locations have escaped poverty in the last 10 – 23 years, between 25% of households at Caihula and 73% at Loro.
- The majority of household income comes from agriculture.
- Households with non-farm income as primary income was highest at Saraida (70%, with 40% of households with government subsidies), Bee Metan (50%). It was lowest at Gorema (7.5%).
- The households that have escaped poverty, are generally associated with:
    - Larger incomes from vegetable sales
    - Larger incomes from livestock sales
    - Non-farm income being more often the primary income source
    - Greater access to a hand tractor
- The most common reported problems for agriculture were:
    - 'Climate change'

- o Pests
- o Strong wind (Gorema and Raebuti Udo)
- The RRA report is in Appendix 2. In summary, it found:
- On-farm yields are generally low for all crops; rice, maize, vegetables and coffee
- On-farm yields have generally been declining for some time. In Raebuti Udo and Gorema, the participants volunteered that perhaps it is associated with a decline in the soil ('a missing vitamin').
- Livestock production is an important income source, often just to service cultural needs (be it sold or given). Free ranging livestock make it difficult to support improved forage systems, but some locations (eg Raebuti Udo) have stronger systems of local governance to control livestock movement.
- Mist flower greatly limits pasture production at Raebuti Udo and Gorema.
- Land preparation, seeding, weeding and harvest consume a lot of household labour. There is often insufficient labour to service the peak periods, so tasks are generally left incomplete as it is not viable to employ labour. Both genders generally agreed that the demands on women's time are excessive, when combined with household tasks, especially during peak on-farm periods. Labour productivity appears an appropriate primary objective in all locations, in whatever way that may be achieved.
- There is a particularly strong women's production group at Saraida, which was one reason that location was selected.
- Weeds are a significant limit to yield, and weeding a significant labour demand. For example, woman hand-weed all vegetable crops at Gorema; a very slow and labourious task.
- Herbicides are the preferred weed control method at Loro and Bee Metan, but non-herbicide weed management techniques are preferred at Raebuti Udo, Gorema, Caihula and Saraida.
- There is a preference for extra on-farm income at Loro, Bee Metan and Gorema, and a belief it can be secured.
- Wet season vegetable production is minimal at Raebuti Udo and Gorema, due to consistent rain and strong winds, increasing the chance of food/nutrition insecurity at this time. Likewise rice production at Raebuti Udo is limited to the dry season.
- Seed supply and implement access were common requests for support

The Food Security Report found that:

- The occurrence of food security concerns seems to be independent of current poverty occurrence (by that location's chosen standards). At the extremes, Bemetan has very low poverty rates (by their standards) but many concerns about food security. Gorema and Saraida have high poverty rates but few concerns about food security.

- The occurrence of food security concerns seems to be independent of the proportion of farmers or proportion with agriculture as primary source of income.

- Strong winds and/or heavy rain, and by inference yield losses caused by them, and being too old to do the required farm work, are a common reason for food insecurity.

Four **monitoring and evaluation research questions** were defined to assess implementation of the chosen innovations at each site

RQ 1.1 – Baseline: What is the current labour productivity, TFP and nutritional yield on current farms?

RQ 1.2 – Annual: Are the chosen innovations both adoptable and adaptable, as answered by farmers in each location?

RQ 1.3 – End of project Have the chosen innovations changed the labour productivity, TFP and nutritional yield measured at the beginning of the project?

RQ 1.4 – End of project: What is/could be the household consequence of improved on-farm labour productivity, TFP and nutritional yield from introduced interventions? What is/could be the freed-time from improved labour productivity 'converted' into? More on-farm activity and income, more off-farm income, more rest and family time? Can it help further households in the target community escape their definition of poverty? How is equity and female empowerment changed, or how could it be?

Research questions regarding soil fertility and plant nutrition are the same for all sites, as follows:

RQ 2.1 What is the most limiting nutrient(s) in current on-farm systems?

RQ 2.2 What is the yield response to adding the most limiting nutrient(s)?

RQ 2.3 What is farmers' assessment of micro-dosing? Does micro-dosing of most limiting nutrient offer sufficient benefit for adoption by the locations farmers?

These research questions are intended to inform the current narrative some use, that fertiliser poisions the soil, by better informing about the role of fertiliser.

Location-specific research questions — on mechanisation, weed management, forage and grazing, rice varieties and plastic tunnel vegetable production — were derived for each site depending on the chosen interventions. These are set out in Table 1, with full details of their derivation provided in Appendix C.

Table 7.1: Location specific research questions.

Location	Research Questions
Betano: Loro	1. What type of mechanization would fit into the system and/or complement the existing mechanization to increase labour productivity in (velvet bean)-maize-mungbean farming system of farmers in Loro? Seeding (soft and harder soil) Harvesting (threshing devices) 2. How can existing herbicides be used for maize crops in Loro, for safety, yield and labour productivity? Land preparation and in-crop. 3. What is the interaction between adding the limiting nutrient and adding velvet bean (before the maize crop or intercropped) on maize yield? 4. How can in-situ grazing best be included in the cropping system?
Betano: Bemetan	1. What type of mechanization would fit into the system and/or complement the existing mechanization to increase labour productivity in (velvet bean)-maize-mungbean farming system of farmers in Beemetan? Seeding (soft and harder soil) Harvesting 2. Can improved governance/control of livestock movement enable a more productive in-situ forage system? 3. What is the interaction between adding the limiting nutrient and adding velvet bean (before the maize crop or intercropped) on maize yield?

Baucau: Caihula (Venilale)	1. What types of mechanization would best fit into the rice system?
	
	• Land preparation
	• Seeding
	• Weed control
	• Harvest
	
	2. What weed management options exist and what is their effect on yield and labour productivity of:
	
	    Rice?
	    Maize?
	    Vegetables?
	
	3. What is the yield of rice varieties suited to this altitude, when transplanted or direct-seeded, compared to currently used varieties? How does adding the limiting nutrient affect yield? Can early water application improve weed control?
	
	4. Can improved governance/control of livestock movement enable a more productive in-situ forage system?

Baucau: Saraida, Aldeia Baguia (Quelicai)	1. What types of mechanization would best fit into the rice system?
	
	• Land preparation
	• Seeding
	• Weed control
	• Harvest
	
	2. What weed management options exist and what is their effect on yield and labour productivity of:
	
	    Rice?
	    Vegetables?
	
	3. Can improved governance/control of livestock movement enable a more productive in-situ forage system?
	
	4. What is the yield of rice varieties suited to this altitude, when transplanted or direct-seeded, compared to currently-used varieties? How does adding the limiting nutrient affect yield? Can early water placement improve weed control?

Ainaro Villa: Aldeia Raibuti-Udo in Suku Manutasi	1. What is the effect on yield of wet and dry season vegetable yield using plastic tunnels compared to open field production? 2. What is the yield of rice varieties suited to this altitude, when transplanted or direct-seeded, compared to currently used varieties? How does adding the limiting nutrient affect yield? 3. What labour-productive land preparation and rice establishment method suits their rice system? Can early water application improve weed control?

Maubisse-Ainaro: Gorema in Horai-quick	1. What mechanization/technologies can be introduced to improve labour productivity for smallholder vegetable farmers in Gorema?
	    Land preparation
	    Seeding
	    Weeding
	    Harvest
	
	2. What weed control and vegetable yield can be achieved with non-manual row seeding + non-manual inter-row weeding + most limiting nutrient?
	
	3. What is the effect on yield of wet and dry season vegetable yield using plastic tunnels compared to open field production?)

Objective 5: Nutrient omission and rate trials

The nutrient omission trials with Betano Research Center, TOMAK and UNTL found a range of limiting nutrients, N and S being the most common (Table 6.1). Almost all locations had a N response, 9 of the 11 locations had an S response (plus Betano Research Centre which

only had and early S response), 4 locations had a P response, 4 locations had a K response and 2 locations had a Zn response.

Table 7.2: A summary of the limiting nutrients determined by nutrient omission trials in the SRA, DS 2023.

Location	Limiting nutrients	Comments
Betano Research Center	N, S (early in season)	Maize. A high CV.
TOMAK:		
Gariwai, Baucau	N and S	Mustard. Negative Zn response.
Uatucarbau, Viqueque	N and S	Mustard.
Batugade, Maliana	P, K and S	Mustard.
UNTL:		
Loro, Betano	N, P, K, S and Zn	Sweet corn.
Bee Metan, Betano	N, K and S	Sweet corn.
Raebuti Udo, Ainaru	N, P, S and Zn	Pak Choi.
Gorema, Maubisse	N and S	Pak Choi.
Caihula, Venilale, Baucau	N and P	Sweet corn. Negative Zn response.
Saraida, Quelicai, Baucau	N, K and S	Sweet corn.
Hera, Dili	N and S	Sweet corn.

Table 7.3: A summary of the soil available nutrients analysed by ICBB, Bogor. Grey cells are low to very low nutrient availability.

Location	pH	N total (%)	P_2O_5 (mg/kg)	Avail K_2O (mg/kg)	Total K_2O (mg/kg)	S (ppm)	Zn (mg/kg)
	In H_2O	Kjeldahl	Olsen	DTPA	HCl 25%	$HClO_4HNO_3$	$HClO_4HNO_3$
Betano Research Center	8.5	0.18	10.16	7.00	4,350	< 1,000	106.99
TOMAK:							
Gariwai, Baucau	5.7	0.22	63.29	8.31	119?	< 1,000	209.71
UNTL:							
Loro, Betano	8.3	0.22	16.92	5.49	4,450	< 1,000	103.01
Bee Metan, Betano	8.3	0.12	17.07	9.44	4,190	< 1,000	79.50
Raebuti Udo, Ainaru	7.4	0.17	15.71	10.63	1,710	< 1,000	101.68

Gorema, Maubisse	6.7	0.09	44.40	9.50	1,860	< 1,000	87.82
Caihula, Venilale, Baucau	8.5	0.15	6.11	8.72	2,310	< 1,000	63.76
Saraida, Quelicai, Baucau	6.9	0.19	< 3.60	11.57	3,050	< 1,000	72.32
Hera, Dili	7.4	0.15	57.45	9.24	4,890	< 1,000	92.99

Table 7.4: A summary of the soil available nutrients ICBB, Bogor.

Soil available nutrient	Very low	Low	Moderate	High	Very high
N (%)*	<0.1	0.1-0.2	0.21-0.5	0.51-0.75	>0.75
P (Olsen P)*	<5	5~10	10~17	17~25	>25
P_2O_5 (Olsen)	<13	13-23	23-40	40-60	>60
Total K_2O (me/100g)*	<10	10-20	20-40	40-60	>60
Total K_2O (mg/kg)	<10,000	10,000-20,000	20,000-40,000	40,000-60,000	>60,000
S (ppm)**		<100	100-2,000	>2,000	
Zn (ppm)**		<10	10-250	>250	

*Djanenuddin (1994), ** Winarso (2005)

Comparing the soil analysis done in ICBB, Bogor, Indonesia (Table 6.2) against the soil critical level (Table 6.3) shows that 7 out of 9 soils are low in Nitrogen (the other two were only just above the low threshold), 6 out of 9 are low in P, and all have very moderate Zn content. Total K_2O appears very low for all locations (maybe there is a mis-match between the analysis method and the threshold), and available K_2O (DTPA) appears to be a very small proportion of total K_2O. S lacks the precision to be conclusive. Of note is:

- Three locations where P levels were low to very low, but no P response was observed: Betano Research Centre, Bee Metan and Saraida. The other locations with low to very low P observed a P response.
- Only three of the locations where soils were sampled had a K response, despite all locations apparently having very low total K.
- Loro and Raebuti Udo had a Zn response, respite apparently having adequate soil Zn.

Nitrogen as a limiting nutrient is not surprising, but the predominance of sulphur as a limiting nutrient across a wide range of locations is novel, and seems to have consequence for fertilizer strategies in Timor Leste. The only current inorganic source of sulphur is SP36, which only has 5% sulphur. If sulphur does prove to be a consistently-required nutrient, other sulphur sources could be considered by MALFF, NGOs and the Timor Leste government, such as single superphosphate or ammonium sulphate. The latter is available in NTT. The commonness of N and S as limiting nutrients has consequence for organic systems also; can compost or manures deliver required N and S, in particular? Based on GAP, compost and other manure contains N, P_2O_5 and K_2O in a lower percentage ranging from 0.4 to 6%.

The UNTL rate trials generally showed a 13-46 per cent response to the low rate of 20 kgN per hectare, 4 kgP, 8 kgK, 4 kgS and 0.2 kgZn per hectare (Table 6.2). The response to the high rate of 100 kgN, 40 kgP, 80kgK, 40 kgS and 2.0 kgZn per hectare was 43-151 per cent. The yield plateau was not reached with the high rate at Bee Metan, Raebuti Udo, Gorema and Hera; higher rates should have been applied to do this, so will likely be done with UNTL students in 2024.

Table 7.5: The mean percentage dry biomass yield response (as percentage of dry biomass yield with Zero fertiliser added) to different rates of NPKSZn fertiliser (N-P-K-S-Zn), at seven locations, by UNTL students, DS 2023

Location	20-4-8-4-0.2 (20% rate)	40-8-16-8-0.4 (40% rate)	60-12-24-12-0.6 (60% rate)	80-16-32-16-0.8 (80% rate)	100-20-40-20-1 (100% rate)
Loro (maize)	113	122	147	144	150
Bee Metan (maize)	119	125	136	146	154
Raebutiudo (pak choi)	121	132	144	133	168
Gorema (pak choi)	146	178	203	206	227
Caihula (maize)	129	154	211	226	227
Saraida (maize)	130	118	171	140	143
Hera (maize)	111	124	184	203	251

The application of a very low (20%) rate of the limiting nutrient appears to produce a useful yield response in many circumstances. This rate is similar to what was applied in micro-dosing trials in Eastern Africa early in the century (Twomlow et al., 2008). Micro-dosing seems a worthy topic of research in Timor-Leste, given many farmers have limited means to purchase fertiliser, and are at early stages of fertiliser adoption and fertiliser supply chains are underdeveloped.

Bonus objective: Trial a simple, cheap Thai-manufactured seeder at Betano Research Centre (BRC)

The 4-row Thai seeder (US$300 in Vientiane) successfully seeded maize, mungbean and rice (Figures 7.1 - 7.3). It reduced the labour requirement for seeding at BRC from 20 labour-days per hectare to and estimated 1.5 labour-days per hectare. This was a good first step towards on-farm seeder uses at neighbouring Loro and Bee Metan.

Figure 7.1: Trial-seeding maize at BRC.

Figure 7.2: The consequent satisfactory emergence at BRC from the trial seeding.

(a)

(b)

Figure 7.3: (a) Patchy mungbean seedling emergence due to inadequate rain after seeding. Subsequent germination filled in many of the patches, and (b) harvesting the drill-seeded mungbean.

It also seeded maize no-till, with hard-faced knife-points installed on the front of the seeder by Dom Bosco in Dili (Figures 7.4 - 7.6).

Figure 7.4: Hard-faced knife-points mounted in front of the tynes on the Thai seeder by Dom Bosco.

Figure 7.5: Trial no-till seeding at BRC. Mulch was removed, but the seeder will handle some surface mulch once the two middle tynes are removed to make a greater inter-tyne space.

Figure 7.6: Satisfactory maize emergence from no-till seeding.

Variation 2 objectives

Rice fertiliser trials

Rice fertiliser trials were established in four locations in wet season 2024: Raebuti Udo (Ainaru) (IR64), Bee Metan (Manufahi) (Nakroma), Saraida (Baucau) (IR64) and Caihula (Baucau) (IR64). Transplanting was delayed at Caihula due to lack of rainfall.

Four treatments were applied:

- Zero fertiliser
- NPK (45-15-15). This is a very conservative rate, about half that recommended in rainfed rice in mainland SE Asia.
- NPKSZn (45-15-15-9-2). A similar very conservative rate.
- 2 x NPKSZn (90-30-30-18-4). This is typical of a recommended rate in rainfed rice in mainland SE Asia.

At Saraida and Bee Metan, there was an error in application of the treatments, so that they were:

- Zero
- NPK (90-30-30). Half applied basally, and half applied topdressed at 40 DAS.
- NPKSZn (90-30-30-18-4). Half applied basally, and half applied topdressed at 40 DAS.
- 2 x NPKSZn (120-60-60-36-8). Half applied basally, and half applied topdressed at 40 DAS.

At Bee Metan, Pocnasa, NPK and NPKSZn had more tillers than Zero, and 2 x NPKSZn more tillers than Pocnasa, NPK and NPKSZn (Table 7.6). At Raebuti Udo both NPKSZn and 2xNPKSZn had greater plant height and tiller number than Zero and NPK, but only at a 85% significance level. At both Saraida at both 50 DAT and 80 DAT, and Caihula at 50 DAT, there was no response of plant height and tiller number to NPK, and a large response to NPKSZn and 2 x NPKSZn (Table 7.7). At both these locations, sulphur and/or zinc appear to be severely limiting nutrients.

Harvest yields will be reported in the first annual report of SLAM-2020-141, as the data will not be available before the end of this SRA.

Table 7.6: The plant height (cm) and tiller number (tillers/m^2) of transplanted rice with four fertiliser treatments (Zero, NPK, NPKSZn and 2 x NPKSZn), at two times of measurement (40 DAT and 80 DAT), at Saraida and Bee Metan, wet season 2024.

Location and date	Zero	Pocnasa	NPK (90-30-30)	NPKSZn (90-30-30-18-4)	2 x NPKSZn (120-60-60-36-8)	LSD (95%)
Saraida						
Plant height @ 50 DAT (cm)	38.0b		35.3b	57.1a	61.3a	4.46
Tiller number @ 50 DAT (tillers/m^2)	4.35c		3.42c	16.1b	22.4a	2.92
Plant height @ 80 DAT (cm)	55.2c		56.4c	83.5b	92.6a	5.60
Tiller number @ 80 DAT (tillers/m^2)	7.17c		7.42c	17.7b	22.8a	2.53
Saraida 2						
Plant height @ 50 DAT (cm)	49.5c	56.5ab	52.5bc	59.6a		5.61
Tiller number @ 50 DAT (tillers/m^2)	13.3c	17.1ab	14.5bc	18.2a		2.38
Bee Metan						
Plant height @ 50 DAT (cm)	75.8b	84.4a	83.6ab	82.6ab	86.6a	4.96
Tiller number @ 50 DAT (tillers/m^2)	16.37c	21.7b	22.9b	21.22b	25.9a	4.02

Table 7.7: The plant height (cm) and tiller number (tillers/m^2) of transplanted rice with four fertiliser treatments (Zero, NPK, NPKSZn and 2 x NPKSZn), at two times of measurement (40 DAT and 80 DAT), at Caihula and Saraida, wet season 2024.

Location and date	Zero	NPK (45-15-15)	NPKSZn (45-15-15-9-2)	2 x NPKSZn (90-30-30-18-4)	LSD (95%)
Caihula					
Plant height @ 50 DAT (cm)	47.1b	49.0b	60.4a	65.9a	6.00
Tiller number @ 50 DAT (tillers/m^2)	6.6c	6.9c	17.3b	21.7a	3.03
Raebuti Udo					
Plant height @ 50 DAT (cm)	33.4b	34.1b	38.1ab	40.2a	6.17
Tiller number @ 50 DAT (tillers/m^2)	4.30	4.02	6.33	6.58	2.71
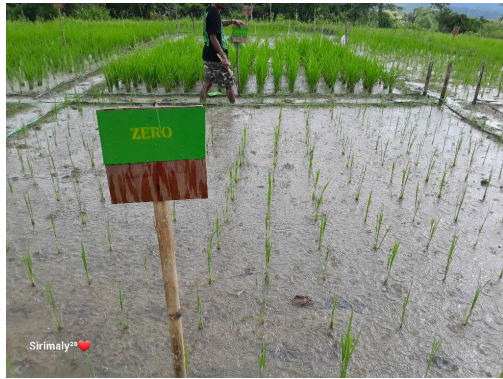
Figure 7.7: Photos of rice plots at 50 DAT, with (a) Zero, (b) NPK, (c) NPKSZn and (d) 2 x NPKSZn, Saraida, wet season 2024.

Training in crop nutrition

Dr Melinda Moata, an SRA team member from Kupang Polytechnic Institute, delivered a presentation to each of the six communities on crop nutrition, from April 6 to April 10, 2024. She delivered the presentation in Bahasa Indonesia, but there was surprisingly good understanding and engagement from all in each community. Melinda covered:

- Macronutrients, micronutrients and their behaviour in soil and crops,
- Symptoms of deficiency,
- Limiting nutrients,
- Typical fertiliser rates and typical crop response to them,
- The soil organic matter pool and fluxes to and from it,
- Use of manures, and
- Basic econonomics of fertiliser use.

There was generally good participation by both men and women, and good discussion with Melinda and between community members about their experiences and questions. Melinda made use of FAO posters on nutrients, crop deficiency and response and basic soil management, in Bahasa Indonesia. The audiences were not large, but given the context of this SRA and subsequent ACIAR project – close engagement with particular communities to explore issues deeper – the audiences were appropriate. All had a chance to engage.

(a)

(b)

Figure 7.8: Dr Melinda Moata delivering crop nutrition training at Gorema, April 9 2024.

UNTL undergraduate student projects

Fourteen UNTL undergraduate students have been selected for 2024 field experiments with the project; seven male and seven female. Twelve of the students will return to the six SRA locations, a pair at each location. The final pair will conduct their field experiments at UNTL's Hera campus.

The students will conduct nutrient omission trials and rate trials with the same crops and similar method to last year, but with the following methodology improvements:

- Larger plots
- Little or no raised plots, as these are unnecessary in the dry season
- Less, more strategic measurements
- Oven-dried dry weight measurements, rather than air-dried
- Full plot harvests
- A wider range of rates in the rate trials, to both get more resolution at low rates (consistent with a research question in SLAM-2020-141)
- Two control plots in each replicate of the nutrient omission trials, to cope with in-field variability

A three-day training on field experimentation was arranged for both the 2023 and 2024 students, with TOSKA, CDU and UNTL staff and co-funded by the Crawford Fund. It featured a field visit to Caihula to discuss the 2023 experiments and possible arrangements and design considerations for 2024.

(a)

(b)

Figure 7.9: The field visit to Caihula as part of the undergraduate training in field experimentation. (a) Francisco Marques, a 2023 undergraduate student, describing their field experimentation experience in their experiment field from last year. (b) Marcia Exposto e Silva posing questions to the student group about TOSKA's wet season rice trial.

(a)

(b)

Figure 7.10: UNTL undergraduate training in field experimentation, (a) 2023 UNTL undergraduates reflect on their field experimentation experience, and (b) Professor Stephen Xu presents on planning a field experiment.

8 Impacts

8.1 Scientific impacts – now and in 5 years

The common occurrence of sulphur as a limiting nutrient, in a wide range of contexts, appears to be a novel and useful finding, given that Timor-Leste is at an early stage of adopting fertilizer inputs. The severity of sulphur and/or zinc as limiting nutrients in rice in Baucau, and the magnitude of the response to a small rate of nutrient addition, suggests that 'a little of everything' is a likely recommendation in those locations.

The early stages of the elevation of the concept of limiting nutrients, and rate of response to them, appears to be useful, given that Timor-Leste is at an early stage of adopting fertilizer inputs and the narrative is often around fertilizer (in general) being 'good' or 'bad'.

8.2 Capacity impacts – now and in 5 years

The Timor-Leste leader of this SRA, Marcia Exposto e Silva, has proven herself a very competent leader. She has engaged with a range of partners, facilitated activities with only remote guidance from the project leader, and managed SRA finances with integrity and transparency.

The broader UNTL Stages of Progress team appeared to gain from being exposed to the SoP method. Understanding 'what works' from engaging with community history, and using that for subsequent action, has been a novel and useful experience for them.

The UNTL undergraduate agriculture degree benefited from final year students being supported to pursue rewarding research questions. The results they obtained, to nutrient omission and rate of nutrient application, was of high quality given the on-farm, isolated context. They have benefitted from engaging a research question which looks to have significance for Timor-Leste agriculture generally.

8.3 Community impacts – now and in 5 years

If the identified limiting nutrients are addressed with even small applications of these nutrients, the yield of their main crops should increase substantially. This should benefit households even when on-farm labour is limited, as product is easily marketed at the six locations.

If the research questions outlined at six locations in this SRA are pursued with any success in a subsequent project, and on-farm labour productivity in particular increases, it will benefit household livelihoods via the freed household time created. This will be biased to women, as the combined demands on their time are more intense than men in the same community, and they are heavily involved in peak on-farm activities.

8.3.1 Economic impacts

If the outlined research questions are pursued with any success in a subsequent project, and on-farm labour productivity in particular increases, it will benefit household livelihoods via the freed household time created, increased on-farm production, or both.

8.3.2 Social impacts

If the outlined research questions are pursued with any success in a subsequent project, and on-farm labour productivity in particular increases, it will benefit household livelihoods via the freed household time created, increased on-farm production, or both. This will be biased to women, as the combined demands on their time are more intense than men in the same community.

8.3.3 Environmental impacts

None as yet.

8.4 Communication and dissemination activities

The final result of the SoP were presented through a Timor-Leste Australia Alumni Association (TL3A) show case event with participants from various sector including Ministry of social, solidarity and inclusion; Australia alumni members, local NGOs, AiCom, TOMAK, UNTL and MALFF social science researchers.

The UNTL undergraduate students presented their findings with seminars at UNTL, Dili, on December 11. These seminars were attended by representatives of three of the six locations, AI-Com staff and UNTL staff and students.

The results of the TOMAK nutrient omission trials were presented to the participating communities by TOMAK in conjunction with TOMAK's fertiliser program in those locations.

The Chefe Aldeia of both Loro and Bee Metan, and the Betano MALFF Extension Worker, attended the seeding event at BRC. They considered its on-farm applicability and were invited to discuss it with surrounding farmers with a view to on-farm use in the 2024 wet season.

9 Conclusions and recommendations

9.1 Conclusions

SoP and RRA process:

The households that have escaped poverty, are generally associated with:

- Larger incomes from vegetable sales
- Larger incomes from livestock sales
- Non-farm income being more often the primary income source
- Greater access to a hand tractor

Crops yields in all locations are very low, and have been declining for some time. Perceived soil deficiencies, seed supply and weeds are common perceived causes of low yields.

Labour supply is a common limit to agricultural production in the six selected locations; some tasks are left incomplete, laborious farming systems reduced/avoided, or some fields left fallow as a consequence. Women in particular have excessive demands on their labour at peak on-farm periods.

There appears to be opportunities for early forms of mechanisation at all locations, for land preparation, seeding, weeding and/or harvest.

Seed supply and tractors/agricultural equipment are the most common forms of requested support.

The market for all incremental farm production is generally good, even in the 'less accessible' locations deliberately chosen. It can be inferred that extra on-farm production will benefit household livelihoods, be it for consumption or sale.

Fertiliser trials:

There appears to be a common occurrence of nitrogen and sulphur being limiting nutrients in the six chosen locations, and in three TOMAK locations and at Hera. The rates of response to even small application rates of limiting nutrients appears to be high.

9.2 Recommendations

Continue to identify limiting nutrients at as many locations and contexts as practical, both to identify the limiting nutrient(s), and develop the narrative of limiting nutrients and response to adding them, to inform fertilizer decisions.

Explore the rate of response to very small rates of the limiting nutrient, known as 'micro-dosing'. This may be a very useful approach in Timor-Leste smallholder systems.

Highlight the importance of labour productivity as an important partial productivity for Timor-Leste agriculture. This can frame activities of a wide range of research and development actors, if they understand the pivotal role of labour productivity.

Carefully specify and introduce appropriate mechanisation to each location, with a focus on both improving labour productivity and having the opportunity for a viable business model for this mechanisation.

Look for opportunities to improve productivity and consistency in vegetable and livestock production, given their common role in households escaping poverty.

Explore methods to improve agricultural seed supply.

10 References

10.1 References cited in report

Inder, B (2023) World Bank report.

Twomlow, S, Rohrbach, D, Dimes, J, Rusike, J, Walter Mupangwa, W, Ncube, B, Hove, L, Moyo, M, Mashingaidze, N, Mahposa, P (2008) Micro-dosing as a pathway to Africa's Green Revolution: evidence from broad-scale on-farm trials, *Nutr Cycl Agroecosyst, 88:3–15*

10.2 List of publications produced by project

N/A

11 Appendixes

11.1 Appendix 1: Stages of Progress Report

11.1.1 Executive Summary

This study was conducted as part of The *Australian Centre for International Agricultural Research* (*ACIAR*) project 'Evaluation of livelihood zones, rural household trajectories, research and development partners and initiatives in Timor-Leste'. This report forms part of the preparation phase for a larger scale agricultural implementation project, 2024-2028. It presents the results of a series of livelihood surveys undertaken using a methodology known as the Stages of Progress, and is designed to assess the prospects for lifting famer household productivity and incomes in three defined livelihood zones; the Mid-altitude irrigated zone (Livelihood Zone 2), the High elevation upland zone (Livelihood Zone 5), and Southern rain-fed zone (Livelihood Zone 7) of Timor-Leste.

Examining the current economic standing (remained poor/escaped poverty/became poor/remained not poor) and their contributing factors for rural farming households based on the local community's perspective, definitions, and criteria under the Stages of Progress methodology can be a useful insight to design the upcoming agriculture projects in those livelihoods' zones. However, it is acknowledged that economic and poverty   related   issues   are   complex and can be investigated both quantitatively and qualitatively to discover possibilities and difficulti es to aid rural farming households in escaping poverty.

In this study, through Focus Group discussion (FGD), the research team facilitate the local community in six study sites (Loro, Bemetan, Raebutiudu, Gourema, Caihula, and Saraida) representing three livelihood zones in Timor-Leste to develop their own perspective and concept to address the two specific following aspects:

➢ What does poverty mean and what qualities does it possess?
➢ What are the typical steps that poor households take to escape poverty?

Following the FGD, a total of 240 households interviewed was conducted (40 HH from each study sites) to obtain a more details information on the factors associated with current economic status of the rural farming households (remained poor/escaped poverty/become poor/remained not poor). The interview focused on the following aspects:

a) Overall households' information and stages of progress
- ☐ Level of progress
- ☐ Main occupation
- ☐ Stages of progress
- ☐ Household size and number of children enrol at school
b) Economic status
- ☐ Type and ownership status of house
- ☐ Main source of income

□ Economic value of selling agriculture products

□ Debts and exchange economy

c) Agriculture related issues

□ Main problem faced

□ Agricultural mechanisation and inputs

□ Support expected

The three main principals used to describe the concept of local poor households in the study areas include: economically powerless, resourceless and visionless. Various terms and indicators used to identify local poor households across the study sites that include: *Familia Kiak, Mukit, Vulneravel, Susar, Kbit Laek, Gimodok, Lesa, Towee, Nokoranu, Nau Nokoranu, Forsa de Doe, Kasian, Forsa Hati, Forsa Doe, Mori Klao, Ataup Sonoan, Nambanei.* Several important measures used to identify local poor households such as: economic dependency of family or person, health condition, shelter conditions, basic shelter facilities, physical and mental condition, capacity to send children to school and university, employment status, income and government support, number of animals owned including traditional materials such as swords (*surik*) and *morten,* capacity to support customary law or tradition, vision of the head of family.

Stages of progress towards escaping poverty established through FGD in Six study locations indicated that obtain food and basic necessities, sending children to school, university, and repair the existing shelter are the main priorities to be achieved for the poor local households to make their way out of poverty (stages 1- 4/poverty cut off line), except for Gourema, where repayment of debt was considered as the first priority (stage 1). Local poor households that managed to achieve stages 4 (in the stages of progress) will no longer consider as poor households.

In general, HH in the six study locations made a positive improvement towards escaping poverty. From a total of 240 households (40 HH from each study sites), over the past 10 – 20 years, aldeia Loro showed to achieve the highest, 73% of HH escaping poverty (Category – B), followed by Raebutiudu, Bemetan, Saraida, Gourema and Caihula, at 45%, 40%, 38%, and 25%, respectively. In contrast to Gourema and Bemetan, where 5% of HH fell into poverty (Category-C) during the same time period, there were zero (0% of HH) in Caihula, Raibutiudu and Saraida. Consequently, Loro had the most progress toward reducing poverty (% Category-B minus % Category-C) at 70%, whilst Caihula had the least at 25%. While Raebutiudu, Saraida, Gourema, and Bemetan had ranges of 45%, 40%, 35%, and 32.5%, respectively.

Comparing the source of income across the six study locations indicates that the majority of HH in all six study sites make an income from agriculture sector, 20-93%. The highest percentage (93%) was in Gourema followed by Caihula 70%, Loro 58%, Raebutiudu 40%, Bemetan 33% and Saraida 20%. The sector of livestock and fisheries only contribute to a maximum of 10% to the HH income. One of the interested points regarding source of income in this study was the contribution of government support. Saraida had the highest percentage (40%), in contrast to Gourema (0%), other four study locations within the range of 5%-15%. Agriculture sector in combination with creating work opportunities in the rural areas are the key sector to help the rural communities escape poverty.

The three main problems related to agriculture work identified in this study include: pests and weeds, change in climate condition (variation on rainfall volume and pattern), and strong winds. To support the agriculture sector having access to agriculture inputs and tractors are essential,

however over 70% of HH in the study locations do not buy fertilizers. Pesticide purchases were higher in Loro and Bemetan (45%), Caihula (25%) and Raebutiudu (10%). Seeds were the most often purchased by farming HH in Gourema (55%) and Caihula (32%). Regarding the use of hand tractors, over 75% of HH in the study locations confirmed they do not own a hand tractor. Aldeia Loro and Bemetan had the highest percentage of tractors rentals, with 68% and 56%.

In terms of accessing to financial support, 45% of HH in Loro and Raebutiudu, have taken out loans or made credits, followed by Gourema 30%, Bemetan 23%, and Caihula 15%. The percentage of HH lending money, in contrast, only accounted for 15% for Loro, while Bemetan, Caihula, and Gourema each accounted for 10%, and in Saraida was less than 10%. Data also demonstrates that the majority of rural HH in the study site do not have access to formal financial institutions; only a very tiny proportion of the rural HH have access to bank financing. To help the rural HH, other private financial institutions like Moris rasik and Kaebauk, as well as association/group are required.

This study demonstrates how the definition of poverty and the standards used to define rural poor families vary depending on the study site by using the stage of progress technique. The stages of progress that have been somewhat established in each of the six study locations imply that the impoverished rural households' attempts to escape poverty follow similar patterns (stages 1- 4). Over the past 10 to 20 years, different livelihoods zones in Timor-Leste, have made varying levels of progress toward escaping poverty. The findings of this study could potentially aid future ACIAR projects in Timor-Leste's, particularly in agricultural sector, helping to boost agricultural productivity and promote the creation of rural employment possibilities to help rural farming communities escape poverty.

11.1.2 Researchers and Research Design

The research team members, sampling and site selection procedure are all described in this section.

Researchers

Four researchers, three from the Faculty of Agriculture and one from the Faculty of Social Science, made up the research team from the National University of Timor-Lorosa'e. One enumerator from the Faculty of Agriculture UNTL's final year as well as twelve field research guides, one from each study location, supported the research team.

Researchers:
- Matias Tavares, PhD (Agriculture Faculty, Research Coordinator)
- Vicente Paulo de Correia, PhD (Agriculture Faculty, Team Member
- Oscar da Silva (Agriculture Faculty, Team Member)
- Bernardo Leto (Faculty of Social Science, Team Member)

Enumerator and research guides:
- Jaime da Silva Gomes (Faculty of Agriculture/UNTL)
- Marcia da Silva (SRA team)
- Juvita Pereira (Manufahi/Same/Betanu/Loro)

- Orlando M. dos Santos (Manufahi/Same/Betanu/Loro)
- Bendito Oranai (Manufahi/Same/Betanu/Bemetan)
- Dina Maria Nunes (Manufahi/Same/Betanu/Bemetan)
- Liliana da Silva (Ainaro/Ainaro vila/Manutasi/Raebutiudu)
- Alipo da Cruz (Ainaro/Ainaro vila/Manutasi/Raebutiudu)
- Augosto da C. Dasilva (Ainaro/Maubisse/Horaikiik/Gourema)
- Abril Pires (Ainaro/Maubisse/Horaikiik/Gourema)
- Aquelina Ximenes (Baucau/Venilale/Uma Ana Ulo/Cai-Hula)
- Sebastiao B. Belo (Baucau/Venilale/Uma Ana Ulo/Cai-Hula)
- Felix N. A. Da Conceicao (Baucau/Quelicai/Baguia/Saraida)
- Albertina Ximenes (Baucau/Quelicai/Baguia/Saraida)

Study Design

This study uses the Stages of Progress (SoP) approach, which relies on a participatory approach and Focus Group Discussions (FGD) to collect data and information from the local community in order to develop its own perspective and concept specifically to address the following aspects:

➢ What does poverty mean in the context of the local community? What are its characteristics?
➢ What are the typical steps that poor households take to escape poverty?

Following the focus group, participants for the HH interviews were chosen from a total of 240 HH from all six study locations. A questionnaire was created, and interviews with chosen participants were done, to deeper our understanding of the poverty issues learned during the FGD. We incorporated the following crucial elements:

In this study, through Focus Group discussion (FGD), the research team facilitate the local community in six study sites (Loro, Bemetan, Raebutiudu, Gourema, Caihula, and Saraida) representing three livelihood zones in Timor-Leste to develop their own perspective and concept to address the two specific following aspects:

➢ What does poverty mean and what qualities does it possess?
➢ What are the typical steps that poor households take to escape poverty?

Following the FGD, a total of 240 households interviewed was conducted (40 HH from each study sites) to obtain a more details information on the factors associated with current economic status of the rural farming households (remained poor/escaped poverty/become poor/remained not poor). The interview focused on the following aspects:

A) Overall households' information and stages of progress

☐ Level of progress
☐ Main occupation
☐ Stages of progress
☐ Household size and number of children enrol at school

B) Economic status

☐ Type and ownership status of house
☐ Main source of income
☐ Economic value of selling agriculture products

□ Debts and exchange economy

C) Agriculture related issues

□ Main problem faced
□ Agricultural mechanisation and inputs
□ Support expected

Sampling Strategy and Data Collection

Three municipalities, Manufahi, Ainaro and Baucau were selected to represent three distinct livelihood zones; the Mid-altitude irrigated zone (Livelihood Zone 2), the High elevation upland zone (Livelihood Zone 5), and Southern rain-fed zone (Livelihood Zone 7).

Six aldeias were chosen from among these three municipalities, and they are as follows (Table 1). Livelihood Zone 5 is represented by Raebutiudu and Gourema (Ainaro); Livelihood Zone 7 is represented by Loro and Beemetan (Manufahi); and Livelihood Zone 2 is represented by Cai-Hula and Saraida (Baucau). Timor-Leste is divided into seven livelihood zones[2]: the Northern rain-fed zone, the Southern rain-fed zone, the Mid-altitude irrigated zone, the South coast irrigated zone, and the Mid-elevation upland zone (Figure 1)
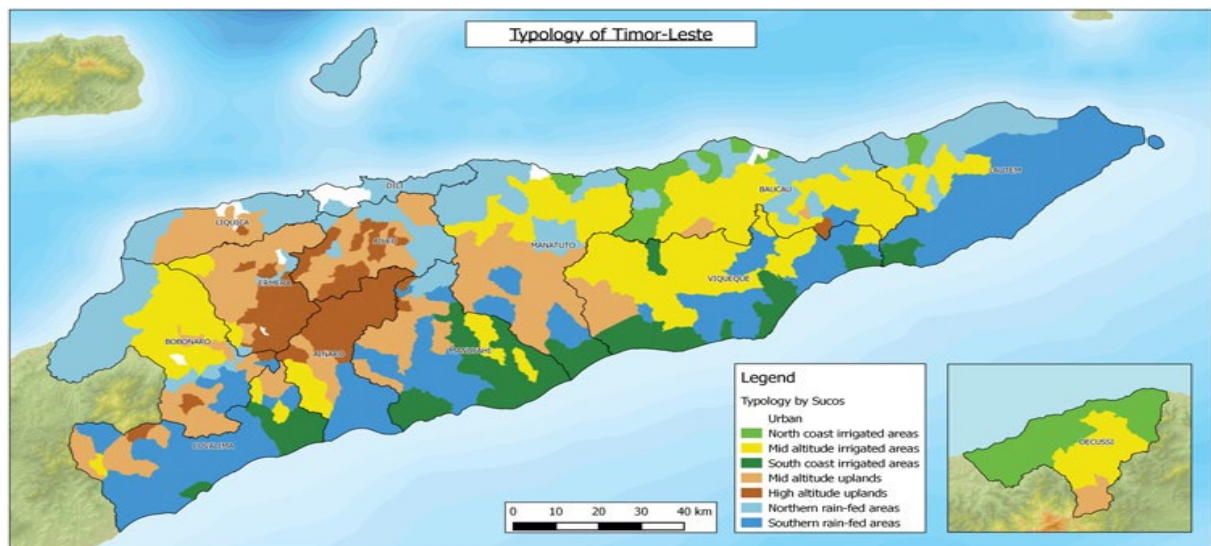
Figure 1. Map of Livelihood Zone in Timor-Leste

There were between 15 and 25 participants in each of the six Focus Group Discussions (FGD) that were held in each study sites. Participants from each aldeia, including village officials, women's groups, farmers, and other community members, represented the community as a whole. 40 HH from each study site were chosen for further interviewing after the Focus Group Discussion.

To ensure that the four different categories—A (Poor then and Poor Now), B (Poor then and not Poor Now), C (Not Poor Then and Poor Now), and D (Not Poor Then and Not Poor Now)—identified in the FGD were all included in the interview, a proportional stratified

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[2] *Williams, R.L., Bacon, S., Ferreira, A. and Erskine, W., 2018. An approach to characterise agricultural livelihoods and livelihood zones using national census data in Timor-Leste. Experimental Agriculture, 54(6), pp.857-873.*

random sampling was used to choose the 40 HH from each study locations. 240 HH in total were interviewed at the six study locations.

Table 1. Livelihood Zone, Study sites and Number of HH Interviewed

Livelihood Zone	Districts	Subdistrict Targeted	*Sucos/Aldeias* Targeted	Households Interviewed
2 **Mid-altitude irrigated zone**	Baucau	Venilale	Uma Ana Ulu/ Cai-Hula	40
		Quelicai	Baguia/Saraida	40
5 **High elevation upland zone**	Ainaro	Ainaro Vila	Manutasi/Raebutiudu	40
		Maubisse	Horaikiik/Gourema	40
7 **Southern rain-fed zone**	Manufahi	Same Vila	Betano/Loro	40
			Betano/Bemeetan	40

11.1.3 Introduction to Stages of Progress (SoP)

The SoP is a survey method that aims to define poverty and prosperity locally, understand the causes of poverty and the characteristics of poor and non-poor rural households, and identify local opportunities (and constraints) that help some households gradually escape poverty through community participative approach such FGD.

The SoP give local communities the opportunity to reflect on their present and past circumstances, which can improve community awareness of local opportunities and constraints that can be used to identify priorities for community needs and to guide decisions about livelihood strategies at the household and community levels. The subsequent actions were
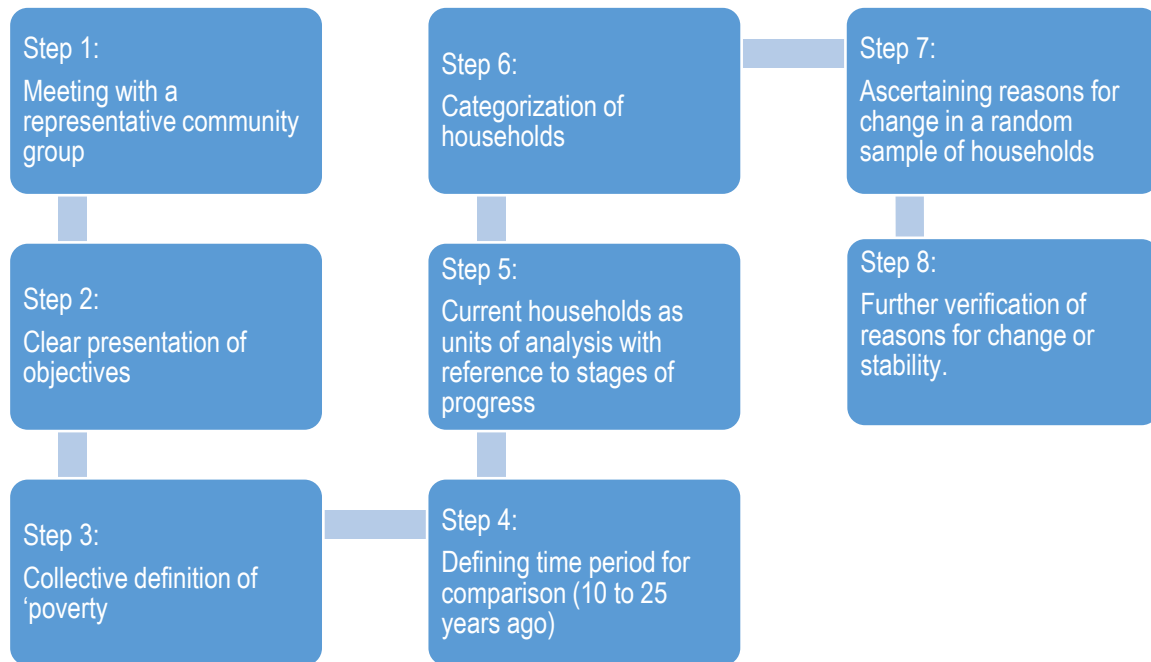
Figure 2. Steps of SoP methodologies[3]

Step 1: meeting with local or village officials and community representative. Shared communal memories concerning the circumstances of local HH or family today and 10 to 25 years ago were elicited. Coordination with local authorities was done to increase community engagement in the FGD.

Step 2: clear presentation of objectives. The research team provided a thorough explanation of the study's goals and methods. This was done to make the goals clear and to emphasize that there are no gains nor losses to be achieved from taking part in these particular community gatherings.

Step 3: Collective description of poverty. It is vitally necessary to define and explore what it means for some households in the society to be considered poor. This phase is crucial since it determines how the activity will proceed moving forward. What does the very poor family do with the first bit of money the family earns? The research team/facilitator posed the following question to the participants of FGD. Which expenditures are typically the very first to be made? What does this household do in the second stage as a bit more money comes in? What happens in the third stage, the fourth stage, and so forth?

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[3] *Krishna, A., 2005. Stages of progress: a community-based methodology for defining and understanding poverty. Retrieved from www.pubpol.duke.edu/krishna/SoP. pdf.*

Step 4: definition of a reference time '10 to 25 years ago' to determine the time frame for comparing HH mobility, the research team had discussions with the participants. As Timor-Leste separated from Indonesia in 1999/2000, some participants prefer to draw comparisons to that year (2000). However, in another area, participants selected a time period for comparison that was 10 years ago.

Step 5: Using existing households as analytic units, consider prior and current stages of progress. This phase involved making a list of every household in the village. The community group was requested to describe each household's current situation as well as its status in the past, consistently making reference to the shared concept of poverty created in earlier Step 3. During this stage, the participants were able to confirm who was actually poor in each era and gauge how poor they were relative to each other by ranking each household's position in relation to the subsequent Stages of Progress. There were some differences of opinion with regard to these classifications, and those that arose were settled by discussion and argument among the present participants to come to the consensus.

Step 6: Household classification. All HH were grouped into one of the following four categories after determining each household's position on the Stages of Progress, both currently and at a prior point in time ('then', 10 to 25 years ago):

Category A — poor then and poor now (remained poor);

Category B — poor then and not poor now (escaped poverty);

Category C — not poor then and poor now (became poor); and

Category D — not poor then and not poor now (remained not poor).

Step 7: Identifying the causes of change in a representative sample of households from each category. From each of the four groups, a random sample of households was chosen. This sample consisted of at least 30% of the HH in each category.

Step 8: Follow-up interviews at the HH level. Individual members of these HHs were interviewed independently after FGD. The research team needed two to three days to complete the interview process in each study location.

11.1.4 Findings

The findings on the ideas and characteristics of poor HH at the six study sites, which represent Timor-Leste's three livelihood zones—the southern rainfed zones, high altitude uplands, and mid-altitude irrigated areas—are presented in the following sections. The six Stages of Progress charts from each research area are also

included, detailing the stages of progress of the HH from destitute/very poor, to non-poor and to prosperous stage.

Concept and Features of Poor Households Across Research Sites

Concept and features of a poor households (HH) established in this report is exclusively based on the opinion of a representative community in the study locations. However, it is acknowledged that poverty is a complex issue that may be measured and understood both qualitatively and quantitatively. Therefore, opportunities and challenges for lifting the households and community out of poverty can be identified.

Being economically powerless, resourceless, and visionless are three local conceptions of what it means to be poor that are either somewhat accentuated or held to the same principal across all six study sites. However, there are significant differences between how poor HH/families are referred to and classified, as well as the terminology utilized. Figure 3, and table below show the various terminology used in each study location to identify poor households (HH) in their community and the indicators used.
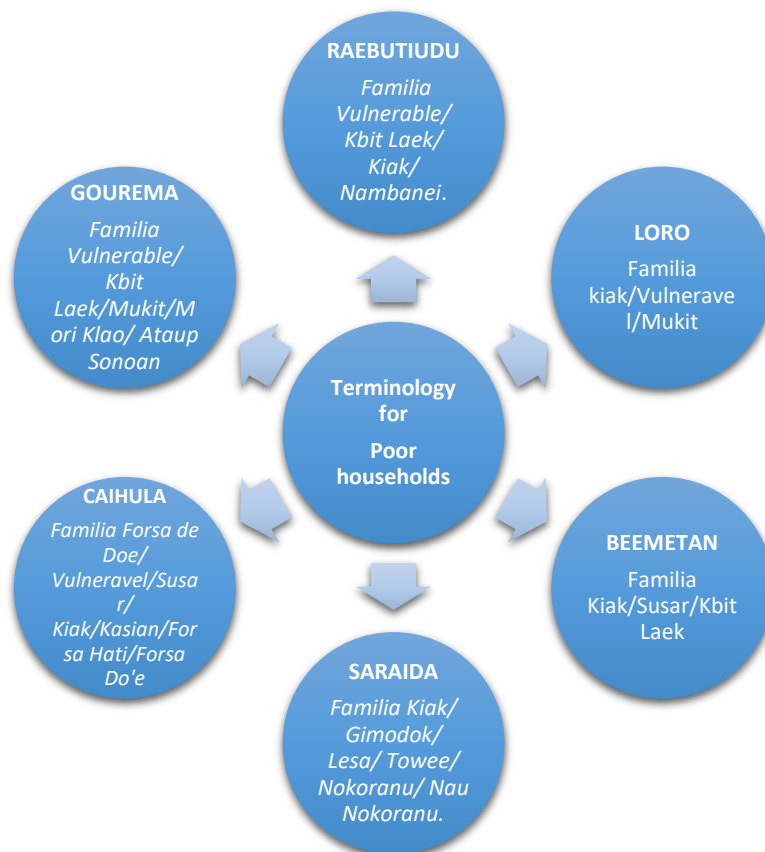
Figure 3. Various terms used to identify poor HH across six study locations

Although various terms were used to describe poor HH, it is standard procedure when implementing SoP for the participants to agree on one term that best described the HH who live with very few resources and is well-known, generally used, and understood by the local community. Following a lengthy discussion, participants in each research site decided to use the following terms to describe the poor HH in their area: **Familia Kiak** (for Caihula), **Familia Nau Nokoranu** (for Saraida), **Familia Kbit Laek** (for Loro, Bemetan, and Raebutiudu), **Familia Mori Klao** (for Gourema).

Table 2. Indicators used to identify poor HH across six study sites

Study sites	Indicators used to identify poor HH
Manufahi/Same/Betano/Loro	- Widows with young children - Receive no/minimum assistance from relatives/other - Dependent on others - Unable to do farm work - Orphan - Have no children and live in poor health condition
Manufahi/Same/Betano/Bemetan	- Advanced age - Poor health condition (physical and mental) - Widows live alone - Poor house condition (broken roof water enters when it rains) - Basic house facilities (table and bed) made of stalk of palm leaves - Unable to enrol children at private university
Ainaro/Ainaro/ Manutasi/Raebutiudu	- A stagnant or unchanged economic situation - A bamboo-built home with just one room and a damaged roof - Beds made of bamboo - A widow who was formerly financially dependent on her spouse - A family without any animals (cattle/pigs/buffalo/goats)
Ainaro/Maubisse/Horaikiik/Gourema	- Not sending children to school when they were young - Not being able to satisfy traditions or customary law - Using bamboo and wood for shelter - Being unable to afford to build a shelter - The family is dependent on others - Head of the family has no vision for the future - Being unable of providing animals for traditional events
Baucau/Venilale/Uma Ana Ulu/Caihula	- Having less than three meals a day - Living in a house made of bamboo or grass - Children are never enrolled in school - Head of the family do not have a vision to improve the life of the family - Having not enough money to pay for the children's education - Having not enough money to repair the existing shelter - Have no/limited land, cultivated fields and paddy fields - Have no animal (cattle/pigs/buffalo/goats)

	- The need to frequently borrow money (accumulate debt) to meet basic necessities of the family
Baucau/Quelicai/Baguia/Saraida	- Not sending children to school and being unable to send them to private universities - Not owning any animals, swords (*surik*), or *morten* - Not having an income - Having inadequate food - Receiving only minimal assistance, including those who are mentally unstable and have no place to live

Stages of HH's progress toward escaping poverty

The steps of progress for the poor HH escaping poverty generated much discussion. Some study settings, including Loro, Saraida, and Caihula, required 5 to 6 hours to finish the FGD.

The interesting finding was that there was widespread agreement on the sequence of these stages across almost all study sites (with the exception of Gourema), particularly in the first three stages (stages 1-3), which participants agreed to list: ***Procured food and basic needs, Enrolled children in school, Repaired the existing shelter***. However, only those in Gourema, the participants of FGD agreed to consider debt repayment as a first stage in the HH's progress upward out of poverty. Figures illustrating HH advancement out of poverty at each study site are presented in the following section.

Stages of Progress in Aldeia Bemetan and Loro, Municipality of Manufahi

The stages of progress in Bemetan and Loro exhibit the same pattern for the first three steps out of poverty, which involve obtaining food, meeting basic requirements, sending children to school, and attending college. Children's education is seen as the most important goal to fulfill in order to lift families out of poverty, above and beyond meeting their basic requirements for food and shelter. During the FGD, it was frequently mentioned that the family had traded off economic advantage, nutritious food and other for the children's education. In Bemetan and Loro, the community representatives agreed to set the poverty cutoff threshold at stage 3. The HH will cease identifying as ***Familia Kbit Laek*** after it has passed stage 3 of the progress. But the HH is regarded as ***Familia Moris Diak Naton.***

The following items are crucial for ***Familia Moris Diak Naton*** to acquire: repairing and building a new home; purchasing a motorcycle or car; participating in and standing up for the customary law (only for Bemetan); purchasing animals (only for Loro); and starting a small business (Stages 4-7), where the line for prosperity life was marked. In aldeia Bemetan standing customary law was regarded as being more significant than Loro. For both aldeias, HHs are categorized as Familia ***Moris Diak Liu/Riku*** as they reach stage 8 (the prosperity cutoff line). The focus of the ***Familia Moris Diak Liu/Riku's*** priority-setting

in both aldeias is on four key areas: charitable giving, saving money, travel, and business investments (Stages 8–11). Investing in agriculture was an earlier priority for Loro; investing in an (agriculture) business was Stage 4 and buying animals Stage 6.

Table 3. Stages of Progress in aldeia Bemetan

Stage 1	Obtaine food for the family				
Stage 2	Obtained clothes and cleaning materials				
Stage 3	Send children to school (Primary to University)		**Kbit laek**		
				Poverty cut off	
Stage 4	Repair/build the existing/new shelter		**Moris diak naton**		
Stage 5	Buy transportation (Motorbike/Car)				
Stage 6	Standing costumery Low/Lia				
Stage 7	Established small business		**Moris diak maton**		
				Prosperity cut off	
Stage 8	Investing in Agriculture business		**Moris diak liu/Riku**		
Stage 9	Save money at the bank				
Stage 10	Travel/Holiday				
Stage 11	Charity				

It was noted during the FGD that there was little disagreement among the participants regarding the stages of progress and the stage at which the boundary between poverty and prosperity should be established. This was most likely due to small number of participants in the FGD, where they were able to easily identify each of the HH in the area.

Table 4. Stages of Progress in Aldeia Loro

Stage 1	Obtaine food for the family					
Stage 2	Obtained clothes and cleaning materials					
Stage 3	Send children to school (Primary to University)		**Kbit laek**			
				Poverty cut off		
Stage 4	Investing in Agriculture business		**Moris diak naton**			
Stage 5	Rapair/build the existing/new shelter					
Stage 6	Buy animals (Cow/Pigs/Goats/Chicken)					
Stage 7	Buy transportation (Motorbike/Car)		**Moris diak maton**			
				Prosperity cut off		
Stage 8	Save money at the bank		**Moris diak liu/Riku**			
Stage 9	Provide money for credit					
Stage 10	Save money at home					
Stage 11	Charity					

Discussion environment observed in Loro was very much different compare to Bemetan, the participants argue heavily on at what stages the poverty cut off line should be drawn. And should a HH that able send/enrol children to university still be considered as *Familia Kbit Laek.* Investing in an agriculture business was Stage 4, earlier than Bemetan.

Stages of Progress in Aldeia Raebutiudu and Gourema Municipality of Ainaro

The results of the FGD in Raebutiudu reveal a pattern that is consistent with other locations, especially in the first three stages of development (Stage 1-3) and the line delineating the poverty threshold. Children's enrolment in school and universities, however, were separated (much like in Aldeia Bemetan). Prioritizing enrolling children in school and university over repairing the current shelter.

A HH is classified as *Familia Kbit Naton* if it reaches Stage 4 of progress. Representatives of the community in Raebutiudu agreed that the following priorities should be completed in that order: purchase animals (the first agriculture investment), save money in the bank, purchase a motorcycle, enrol children in college, and construct new housing (Stages 4-8) for the *Familia Kbit Naton* to progress their journey out of poverty.

Families that have succeeded beyond Stage 8 (prosperity cut off line) are placed in a new category known as *Familia Moris Diak*. *Familia Moris Diak* in Raebutiudu has five priorities to be accomplished, including buying a car, participating in charitable activity, starting a new business, traveling, and acquiring more land (Stages 9–13).

Table 5. Stages of Progress in Aldeia Raebutiudu

Stage 1	Obtaine food for the family				
Stage 2	Send children to school (Primary to Senior High)				
Stage 3	Rapair the existing shelter			**Kbit laek**	
					Poverty cut off
Stage 4	Buy animals (Cow/Pigs/Goats/Chicken)			**Moris naton**	
Stage 5	Save money at the bank				
Stage 6	Buy transportation (Motorbike)				
Stage 7	Send Children to University				
Stage 8	Build new shelter			**Kbit naton**	
					Prosperity cut off
Stage 9	Buy transportation (Car)			**Moris diak**	
Stage 10	Carity				
Stage 11	Establish new business (agriculture/manufacturing)				
Stage 12	Travel/Holiday				
Stage 13	Buy/Obtain more land				

The interesting aspect of discussion in defining the stages of progress in Raebutiudu was on placing the priority between enrolling children at school before repairing the existing shelter; and enrolling children at university before building a new shelter (The intense debate on these aspects was also observed in other locations). The consensus was prioritized education for children over repair and the need for build new housing.

In comparison to the other study locations, the stages of progress produced in Gourema's figures are seen significantly different. Participants in the FGD unanimously agreed that repayment of debt (especially for food and *lia*) should be the **Mori Klau** Family's top goal at Stage 1 as they work to escape poverty. In Gourema, **Familia Mori Klau** gave priority to completing the four essential tasks of paying off debt, obtaining food and basic needs, and enrolling children in school and university (Stages 1-4). In order to disqualified the HH from this category, the HH had to cross the poverty line (stage 4) and move on to the new category known as **Familia Mori Kode.**

Familia Mori Kode has new goals to accomplish, including repairing the current shelter, purchasing animals (the first agriculture investment), and starting a new business (Stages 5-7). When Familia **Mori Kode's** life progresses further and reaches the prosperity cutoff line (Stages 7), it moves into a new category called **Familia Mori Kode Liu**. In this category, the family's priorities shift to charitable endeavours, motorbike purchases, the construction of new homes, and financial business establishment. Investment in agriculture is a relatively early priority; buying animals is Stage 6 and establishing a new (agriculture) business is Stage 7.

Table 6. Stages of Progress in Aldeia Gourema

Stage 1	Pay debt (food and lisan)				
Stage 2	Obtaine food for the family				
Stage 3	Obtain basic needs (Coocking utensils…)				
Stage 4	Send children to school (University)			Mori klau	
					Poverty cut off
Stage 5	Rapair the existing shelter			Mori kode	
Stage 6	Buy animals (Cow/Pigs/Goats/Chicken)				
Stage 7	Establish new business (shop/agriculture)			Mori kode	
					Prosperity cut off
Stage 8	Carity			Mori kode liu	
Stage 9	Buy transportation (Motorbike)				
Stage 10	Build new shelter				
Stage 11	Establish credit/loan business				

Debt is seen as a crucial mechanism for the **Mori Klau Family** to survive and progress, which is one of the significant reasons for the community in Gourema to list repayment of debt as a first priority (Stages 1) for the Mori Klau Family on their progress towards prosper living. Also, being a provider of debt finance is a final stage of **Mori Kode Liu**. Therefore, settling debt is a way of building the trust between lenders and borrowers. Keeping the word and gain trust from other member of community particularly money lenders is crucial.

Stages of Progress in Aldeia Caihula and Saraida, Municipality of Baucau

The community in aldeia Caihula came up with the longest list in the construction of stages of progress. The first three stages were similar to most other locations. Participants in the FGD agreed that in order for the **Familia Moris Kiak** to progress out of poverty, their top three priorities should be to buy food for the family, fix their current home, and send their children to school and higher education (Stages 1-3).

The family no longer identifies as Familia Moris Kiak but is now known as **Familia Moris Naton** after successfully completing Stage 4 (the poverty cut off line). The following items were chosen as the family's top priorities to concretize (Stages 4-7) within the category of **Familia Moris Naton**: start a new business, save money at home, send children to college, and settle debt. The family is referred to be **Familia Moris Diak** if its accomplishments go beyond Stage 7 (prosperity is cut off line). Investment in agriculture is a relatively early priority; starting a new (agriculture) business is Stage 4.

Familia Moris Diak in Aldeia Caihula has established a number of goals, including saving money at the bank, constructing a new home, purchasing a motorcycle and a vehicle, and starting a new business. The family that successfully completed stage 13 is classified as **Familia Moris Diak Liu**, and within this category, the family's focus shifts to obtaining bank credit, traveling, and taking vacations.

Table 7. Stages of progress in Aldeia Caihula

Stage 1	Obtaine food for the family				
Stage 2	Rapair the existing shelter				
Stage 3	Send children to school (Primary to Senior High)			**Moris kiak**	
					Poverty cut off
Stage 4	Establish new business (shop/agriculture)			**Moris naton**	
Stage 5	Save money at home				
Stage 6	Send children to university				
Stage 7	Pay debt			**Moris naton**	
					Prosperity cut off
Stage 8	Save money at the bank			**Mori diak**	
Stage 9	Build new shelter				
Stage 10	Buy/obtaine more land				
Stage 11	Buy transportation (Motorbike)				
Stage 12	Buy transportation (Car)				
Stage 13	Establish new company			**Moris diak**	
Stage 14	Access to credit/loan from the bank			**Moris diak liu**	
Stage 15	Travel/Holiday				

Should paying off debt (Stage 7) be included in the stages of progress? In Caihula, this question was one of the FGD's most contentious issues. Proponents argued that in order

for *Familia Kiak* to survive, debt is unavoidable. Paying off debt should therefore be taken into consideration once the *Familia Kiak's* financial situation improves. Contrarily, it is argued that *Familia Kiak* cannot borrow money from others or have access to credit. And who will provide them with a loan? After several counterarguments, the participants in this discussion finally agree that paying off debt should be included in the stages of progress.

In contrast to Caihula, stages of progress produced in Saraida consisted of only eight stages, making it the shortest compared to other locations. School (Stage 2) and university (Stage 3), which were allocated independently, made the first three stages in Saraida different from those in other locations. Once progress has been accomplished beyond Stage 3 (the poverty cut off level), the HH will no longer refer to the family as *Familia Nau Nokoranu*; instead, they will identify as *Familia Hai Sebi Rau.*

The two next priorities in the category of *Hai Sebi Rau* family were repairing and constructing a new house and supporting customary events (Stages 5 and 6). *Familia Hai Riku* or *Nita Rau* was the name given to the family after Stage 5. Priorities set by this group included purchasing housing amenities, purchasing livestock, motorbike and car. HH investment in agriculture does not seem an early priority; purchasing livestock is Stage 7.

Throughout the FGD, it was observed that at the beginning the participants showed little interest and avoided talking about things that were out of their current reach. The participants preferred to concentrate on their existing problems and how to solve them, such as irrigation and basic infrastructure.

Table 8. Stages of Progress in Aldeia Saraida

Stage 1	Obtaine food and basic needs for the family			
Stage 2	Send children to school (Primary to Senior High)			
Stage 3	Send children to university		**Nau nokoranu**	
				Poverty cut off
Stage 4	Standing customary events		**Hai sebi rau**	
Stage 5	Rapair/build the existing/new shelter		**Hai sebi rau**	
				Prosperity cut off
Stage 6	Buy/obtaine house facilities(TV/Freezer….)		**Hai riku/Nita rau**	
Stage 7	Buy animals (cattle/pigs/goats/chicken)			
Stage 8	Buy transportation (Motorbike/Car)			

Participants argued passionately about which aspect of the stages of progress should be prioritized first, such as enrolling children in school and university over upholding customary law and renovating or constructing new housing. Participants considered both enrolling children at school as well as upholding customary law are important. Ultimately consensus was made to place children education on the top of customary law and building new shelter.

Another intriguing point discussed during the FGD was whether or not a family should be regarded as *Familia Nau Nokoranu* if they were able to send their children to college. Or the family should be regarded as *Familia Hai Sebi Rau*. After hearing both pro and con arguments, participants ultimately decided to list the HH *as Familia Nau Nokoranu*. The main defence was that sending children to college require a lot of money, and if they leave college without a job, they don't help the family financially.

A common theme across all locations, was that investment in education was generally a higher priority than investment in business — agriculture or otherwise. Perhaps we can infer from this the high importance of wages income (from educated family members) in a household's diversified livelihoods strategy.

11.1.5 Comparison Analysis between six study sites

The following section provide a comparison analysis of six study sites, particularly focusing on the outstanding features and highlight the similarities and differences among these areas. The analysis covering the following three main themes include:
   a) Overall household information and stages of progress (Level of progress, Main occupation and household size, Number of dependent family currently enrolled at school).
   b) Economic status (Type and ownership status of house, Main source of income, economic value of selling vegetables and livestock, debts and exchange economy.
   c) Agriculture related issues (main problems faced in agriculture sector, agricultural mechanisation and inputs, support expected)

Comparison of Stages of Progress

The following table contrasts the patterns of poverty in the three municipalities that stand in for Timor-Leste's three livelihood zones (2, 5, 7) with the six research locations. The percentage of HH who were able to escape poverty (Category-B) over the past 10 to 20 years, as shown by the data in the table, was highest in the aldeia Loro, at 72.5%, and was followed by Raebutiudu, Bemetan and Saraida, Gourema, and Caihula, at 45%, 40%, 37.5%, and 25%, respectively. In contrast to Gourema and Bemetan, where 5% of HH fell into poverty (Category-C) during the same time period, there were zero (0% of HH) in Caihula, Raibutiudu and Saraida. Consequently, Loro had the most progress toward reducing poverty (% Category-B minus % Category-C) at 70%, whilst Caihula had the least at 25%. While Raebutiudu, Saraida, Gourema, and Bemetan had ranges of 45%, 40%, 35%, and 32.5%, respectively.

As we can observe from the data that the HH in all six aldeias made a positive improvement towards escaping poverty. Ten to twenty years ago almost all HH in Caihula and Saraida were categorized as poor, and today the figure has fallen to 75% and 60% respectively. While in Loro the percentage of poor HH was dropped from 93% to 23%, Raebutiudu 98%

to 53%, Gourema 83% to 50% and Bemetan 45% to 10%. (25% - 72.5%). The figures suggest that the rate of poverty reduction (under the community perspective) was different across the country. This might be an indication of the need for a deeper evaluation towards policy development and its effectiveness to address poverty issues in rural areas. Factors that might associate and contribute to differs the dynamics of poverty in these aldeias are presented in the next section of this report.

Table 9. Number of Household in Four Categories in Six Study Sites

			Percentage of HH over the past 10 to 20 years				
			A (Remained poor)	B (Escaped poverty)	C (Become poor)	D (Remained not poor)	Total
Aldeia	Bemetan	Count	2	16	2	20	40
		% within Aldeia	5.00%	40.00%	5.00%	50.00%	100.00%
	Caihula	Count	30	10	0	0	40
		% within Aldeia	75.00%	25.00%	0.00%	0.00%	100.00%
	Gourema	Count	18	15	2	5	40
		% within Aldeia	45.00%	37.50%	5.00%	12.50%	100.00%
	Loro	Count	8	29	1	2	40
		% within Aldeia	20.00%	72.50%	2.50%	5.00%	100.00%
	Raebutiudu	Count	21	18	0	1	40
		% within Aldeia	52.50%	45.00%	0.00%	2.50%	100.00%
	Sara Ida	Count	24	16	0	0	40
		% within Aldeia	60.00%	40.00%	0.00%	0.00%	100.00%
Total		Count	103	104	5	28	240
		% within Aldeia	42.90%	43.30%	2.10%	11.70%	100.00%

Comparison of Sociodemographic Characteristics

Table 10 and 11 present comparison information on the sociodemographic information such as main occupation, member of family and number of children currently enrolled at school in the six study sites area. The majority of respondents (48% - 85%) were engaged in agriculture sector as farmers, Gourema with the highest percentage (85%), followed by Caihula 83%, Saraida 78%, Loro 68% and Bemetan 19%. Other occupations engaged by

the respondents only in a small percentage of less than 20%, include Civil servant and others (fisheries/small business owner/driver).

Table 10. Main Occupation, Number of Family and Children Currently Enrolled at School

			Principal Occupation				
			Farmers	Civil Servant	Housewife	Others	Total
Aldeia	Bemetan	Count	19	6	8	7	40
		% within Aldeia	47.5%	15.0%	20.0%	17.5%	100.0%
	Caihula	Count	33	2	1	4	40
		% within Aldeia	82.5%	5.0%	2.5%	10.0%	100.0%
	Gourema	Count	34	0	1	5	40
		% within Aldeia	85.0%	0.0%	2.5%	12.5%	100.0%
	Loro	Count	27	3	2	8	40
		% within Aldeia	67.5%	7.5%	5.0%	20.0%	100.0%
	Raebutiudu	Count	24	3	9	4	40
		% within Aldeia	60.0%	7.5%	22.5%	10.0%	100.0%
	Sara Ida	Count	31	4	1	4	40
		% within Aldeia	77.5%	10.0%	2.5%	10.0%	100.0%
Total		Count	168	18	22	32	240
		% within Aldeia	70.0%	7.5%	9.2%	13.3%	100.0%

The number of members in the HH varies among study sites area, in Saraida, 30% of the HH had a family member between 1-3. Whiles 50% of the HH in Loro with 4-5 family members. In Gourema 38% of the HH had a family member between 7-9, and Reabutiudu 25% of HH with 10-12 family member. In a very rare cases, 2.5% of HH in Gourema and Reabutiudu had 13-15 family member. The number of family within the HH can affect the poverty dynamic, those with many children (family member in the HH) have higher needs compared to those with fewer one. Particularly, spending or investment in education for the family member is costly, and it takes a long time (18-25 years) to get the return. However, in the areas that are dominated by farmers (study sites), having many children (large family member) can be an asset as a labour force for agriculture work, notwithstanding the household may benefit from some of those family members working off-farm.

Table 11. Number of people in the HH per aldeia

			1.00-3.00	4.00-6.00	7.00-09.00	10.00-12.00	13.00-15.00	Total
Aldeia	Bemetan	Count	9	17	11	3	0	40
		% within Aldeia	23%	43%	27.5%	8%	0.0%	100.0%
	Caihula	Count	6	19	12	2	0	39
		% within Aldeia	15%	49%	30.8%	5%	0.0%	100.0%
	Gourema	Count	5	14	15	5	1	40
		% within Aldeia	13%	35%	37.5%	13%	2.5%	100.0%
	Loro	Count	10	19	8	1	0	38
		% within Aldeia	26%	50%	21.1%	3%	0.0%	100.0%
	Raebutiudu	Count	2	14	13	10	1	40
		% within Aldeia	5%	35%	32.5%	25%	2.5%	100.0%
	Sara Ida	Count	12	17	10	1	0	40
		% within Aldeia	30%	43%	25.0%	3%	0.0%	100.0%
Total		Count	44	100	69	22	2	237
		% within Aldeia	18%	42%	28.8%	9%	0.8%	100.0%

Table 12. Number of children in household attending school per aldeia

			No. of children attending school			
			0-2	3-5	6-8	Total
Aldeia	Bemetan	Count	14	16	1	31
		% within Aldeia	45.2%	52%	3%	100.0%
	Caihula	Count	19	9	0	28
		% within Aldeia	67.9%	32%	0%	100.0%
	Gourema	Count	21	11	0	32
		% within Aldeia	65.6%	34%	0%	100.0%
	Loro	Count	19	9	0	28
		% within Aldeia	67.9%	32%	0%	100.0%
	Raebutiudu	Count	11	9	7	27
		% within Aldeia	40.7%	33%	26%	100.0%
	Sara Ida	Count	17	11	1	29
		% within Aldeia	58.6%	38%	3%	100.0%
Total		Count	101	65	9	175
		% within Aldeia	57.7%	37.14%	5.1%	100.0%

Table 12 shows the number of children currently enrolled in school by HH in each study sites. The number of children that are currently enrolled at school (elementary – University) in the six study sites varies from 3%-68%. Caihula and Loro were with the highest percentage (68%) of enrolling 0-2 children enrolled at school, followed by Gourema 66%, Saraida 59%, Bemetan 45% and Raebutiudu 47%. Bemetan had 52% of HH enrolled 3-5 children, and Saraida with 38%. Raebutiudu had 26% of the HH enrolled 6-8 children at school, this is due to their large family size. Having many children enrolled at school, spending or investment in education for the family member is costly, and it takes a long time (18-25 years) to get the return.

Comparison of Ownership Status and Type of House

The vast majority of HH (> 80%) in all study sites confirmed owning their shelter. Loro and Raebutiudu had the highest percentage (17%) of HH that did not own their shelter, followed by Caihula (15%), Bemetan (13%), Saraida and Gourema (10%), those family not owning their shelter living in the relative's houses. The high percentage of owned house status is generally applied to the rural HH in Timor-Leste, as the property, land and house that owned/occupied by the ancestors who are then left for the next generation to be passed down from generation to generation.

Table 13. Ownership status of the house

| | | | Owned the House | | |
			No	Yes	Total
Aldeia	Bemetan	Count	5	35	40
		% within Aldeia	12.5%	87.5%	100.0%
	Caihula	Count	6	34	40
		% within Aldeia	15.0%	85.0%	100.0%
	Gourema	Count	4	36	40
		% within Aldeia	10.0%	90.0%	100.0%
	Loro	Count	7	33	40
		% within Aldeia	17.5%	82.5%	100.0%
	Raebutiudu	Count	7	33	40
		% within Aldeia	17.5%	82.5%	100.0%
	Sara Ida	Count	4	36	40
		% within Aldeia	10.0%	90.0%	100.0%
Total		Count	33	207	240
		% within Aldeia	13.8%	86.3%	100.0%

Regarding the type of houses, 48% of the HH in Caihula live in types of houses made from timber/bamboo and thatched roof (Type-A houses), other 43% of HH stay in house made of timber/bamboo and corrugated iron roof (Type-B houses). In contrast to Saraida (15%), Raebutiudu (18%), Loro and Gourema (20%) and Bemetan (38%) of the HH live in type-A house.

Table 14. Type of House

			TipuUma										
			A-timber/bamboo/thatched roof	B-timber/bamboo/corrugated iron roof	C-Brick/ceramics	C-Bricks/No ceramics	D-Half wall/Ceramics	D-Bricks/iron roof	D-Bricks/Palmstalk/iron roof	D-Brick/iron roof/no-ceramics	D-Other	N/A	Total
Aldeia	Bemetan	Count	15	5	13	0	0	3	2	0	1	1	40
		% within Aldeia	37.5%	12.5%	32.5%	0.0%	0.0%	7.5%	5.0%	0.0%	2.5%	2.5%	100.0%
	Caihula	Count	19	17	4	0	0	0	0	0	0	0	40
		% within Aldeia	47.5%	42.5%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	Gourema	Count	8	11	7	0	0	8	0	3	2	1	40
		% within Aldeia	20.0%	27.5%	17.5%	0.0%	0.0%	20.0%	0.0%	7.5%	5.0%	2.5%	100.0%
	Loro	Count	8	7	5	0	1	14	2	1	1	1	40
		% within Aldeia	20.0%	17.5%	12.5%	0.0%	2.5%	35.0%	5.0%	2.5%	2.5%	2.5%	100.0%
	Raebutiudu	Count	7	11	7	7	0	5	0	0	0	3	40
		% within Aldeia	17.5%	27.5%	17.5%	17.5%	0.0%	12.5%	0.0%	0.0%	0.0%	7.5%	100.0%
	Sara Ida	Count	6	14	7	6	2	2	0	2	0	1	40
		% within Aldeia	15.0%	35.0%	17.5%	15.0%	5.0%	5.0%	0.0%	5.0%	0.0%	2.5%	100.0%
Total		Count	63	65	43	13	3	32	4	6	4	7	240
		% within Aldeia	26.3%	27.1%	17.9%	5.4%	1.3%	13.3%	1.7%	2.5%	1.7%	2.9%	100.0%

Comparison of income sources and their value

The majority of HH in all six study sites make an income from agriculture sector, 20-93% (Table 15). The highest percentage (93%) was in Gourema followed by Caihula 70%, Loro 58%, Raebutiudu 40%, Bemetan 33% and Saraida 20%. The sector of livestock and fisheries only contribute to a maximum of 10% to the HH income. Particularly in Bemetan a fixed/permanent job contribute 20%, and Saraida 13% to the HH income. One of the interested points regarding source of income in this study was the contribution of government support. Saraida had the highest percentage (40%), in contrast to Gourema (0%), other four study locations within the range of 5%-15%. There are various supports offered by the national government to the qualified person/family, veteran, disability, old age, bolsa da main. The government support targeted poor family aims at reducing poverty and dignified its citizens (eg veteran and disabled people).

Table 15. Principal source of Income

			Children/Relatives	Business (coffee, small shop, bread, tempre, tais)	Renting room and car	Permanent salary	Agriculture sector	Livestock sector	Fisheries sector	Casual work (project and farm)	Profesional work(karpenter/ driver/advisor)	Government Subsidies	Other	Total
							Principal Income - 2022							
Aldeia	Bemetan	Count	2	1	2	1	8	13	3	4	0	2	4	0	40
		% within Aldeia	5.0%	2.5%	5.0%	2.5%	20.0%	32.5%	7.5%	10.0%	0.0%	5.0%	10%	0%	100.0%
	Caihula	Count	1	1	2	0	1	28	3	0	0	1	2	1	40
		% within Aldeia	2.5%	2.5%	5.0%	0.0%	2.5%	70.0%	7.5%	0.0%	0.0%	2.5%	5%	3%	100.0%
	Gourema	Count	0	0	1	0	0	37	0	0	0	2	0	0	40
		% within Aldeia	0.0%	0.0%	2.5%	0.0%	0.0%	92.5%	0.0%	0.0%	0.0%	5.0%	0%	0%	100.0%
	Loro	Count	1	1	3	0	2	23	1	1	0	3	2	3	40
		% within Aldeia	2.5%	2.5%	7.5%	0.0%	5.0%	57.5%	2.5%	2.5%	0.0%	7.5%	5%	8%	100.0%
	Raebutiudu	Count	3	1	1	0	2	16	2	0	4	4	6	1	40
		% within Aldeia	7.5%	2.5%	2.5%	0.0%	5.0%	40.0%	5.0%	0.0%	10.0%	10.0%	15%	3%	100.0%
	Sara Ida	Count	1	0	1	1	5	8	4	0	1	2	16	1	40
		% within Aldeia	2.5%	0.0%	2.5%	2.5%	12.5%	20.0%	10.0%	0.0%	2.5%	5.0%	40%	3%	100.0%
Total		Count	8	4	10	2	18	125	13	5	5	14	30	6	240
		% within Aldeia	3.3%	1.7%	4.2%	.8%	7.5%	52.1%	5.4%	2.1%	2.1%	5.8%	13%	3%	100.0%

The value of sales revenue from vegetables and livestock

In the three months prior to the time of the survey, the majority of HH across all study sites confirmed having obtained revenue from selling vegetables and livestock (Table 16). Gourema had the biggest difference (98% vs. 10%) in the percentage of HH who sold vegetables as opposed to livestock. In contrast to Gourema, only 20% of HH in Saraida get money by selling vegetables, compared to 48%, who received income from selling animals. In Loro, HH made up 67% of those who traded in vegetables and 40% of those who traded in animals. While in Raebutiudu, just 25% of HH's income came from livestock and 53% came from selling vegetables. In Bemetan, the percentage of HH who generated money trading animals and vegetables was relatively similar, at 45% and 48%, respectively. HH earned significantly diverse sources of revenue from selling vegetables and cattle in the research areas because of variations in topography, road conditions, and market accessibility.

Table 16. Income generated by the sale of vegetables and livestock in the study locations

			Income from selling vegetables		
			No	Yes	Total
Aldeia	Bemetan	Count	22	18	40
		% within Aldeia	55.0%	45.0%	100.0%
	Caihula	Count	14	26	40
		% within Aldeia	35.0%	65.0%	100.0%
	Gourema	Count	1	39	40
		% within Aldeia	2.5%	97.5%	100.0%
	Loro	Count	13	27	40
		% within Aldeia	32.5%	67.5%	100.0%
	Raebutiudu	Count	19	21	40
		% within Aldeia	47.5%	52.5%	100.0%
	Sara Ida	Count	32	8	40
		% within Aldeia	80.0%	20.0%	100.0%
Total		Count	101	139	240
		% within Aldeia	42.1%	57.9%	100.0%

			Income from selling livestock		
			No	Yes	Total
Aldeia	Bemetan	Count	21	19	40
		% within Aldeia	52.5%	47.5%	100.0%
	Caihula	Count	19	21	40
		% within Aldeia	47.5%	52.5%	100.0%
	Gourema	Count	36	4	40
		% within Aldeia	90.0%	10.0%	100.0%
	Loro	Count	24	16	40
		% within Aldeia	60.0%	40.0%	100.0%
	Raebutiudu	Count	30	10	40
		% within Aldeia	75.0%	25.0%	100.0%
	Sara Ida	Count	21	19	40
		% within Aldeia	52.5%	47.5%	100.0%
Total		Count	151	89	240
		% within Aldeia	62.9%	37.1%	100.0%

Across the six study locations, there were differences in the economic value or income generated by selling vegetables and livestock in the three months preceding to the survey. 57% of the HH in Raebutiudu made up to $50 from selling vegetables, and 17% made between $200 and $325. In comparison, 50% of HH made up to $75 by selling animals. In Gourema, 40% of HH produced up to $50 from selling vegetables, 35% made between $200 and $325, 21% made $60 to $100, and 5% made between $360 and $500. In contrast, only 2% of HH sell animals for a profit of no more than $600, the majority of their revenue comes from agriculture, particularly horticulture.

Table 17. Economic value of selling vegetables

			Economiv value of selling vegetables							
			2.50-50.00	60.00-100.00	120.00-180.00	200.00-325.00	360.00-500.00	550.00-800.00	900.00-1500.00	Total
Aldeia	Bemetan	Count	4	3	4	2	2	1	1	17
		% within Aldeia	23.5%	17.6%	23.5%	11.8%	11.8%	5.9%	5.9%	100.0%
	Caihula	Count	4	2	1	8	3	1	1	20
		% within Aldeia	20.0%	10.0%	5.0%	40.0%	15.0%	5.0%	5.0%	100.0%
	Gourema	Count	15	8	13	0	2	0	0	38
		% within Aldeia	39.5%	21.1%	34.2%	0.0%	5.3%	0.0%	0.0%	100.0%
	Loro	Count	9	8	3	3	1	1	1	26
		% within Aldeia	34.6%	30.8%	11.5%	11.5%	3.8%	3.8%	3.8%	100.0%
	Raebutiudu	Count	13	3	2	4	1	0	0	23
		% within Aldeia	56.5%	13.0%	8.7%	17.4%	4.3%	0.0%	0.0%	100.0%
	Sara Ida	Count	6	0	0	0	0	0	0	6
		% within Aldeia	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total		Count	51	24	23	17	9	3	3	130
		% within Aldeia	39.2%	18.5%	17.7%	13.1%	6.9%	2.3%	2.3%	100.0%

Additionally, only 6 HH (100%) in Saraida created income from the sale of vegetables with a price up to $50, while from a total of 18 HH that produced income from the sale of animals, 10% made up to $75, 2% made between $80 and $100, $250 and $400, and 4% made between $450 and $600. By selling vegetables, 35% of HH in Loro made up to $50, 31%

between $60 and $100, 12% between $120 and $180, and $200 and $325. Less than 5% of HH's earnings were in the range of $360 and $1500.

Table 18. Economic value of selling livestock

			Economic value of selling livestock									
			5.00-75.00	80.00-200.00	250.00-400.00	450.00-600.00	630.00-800.00	806.00-1280.00	1500.00-1800.00	1820.00-2000.00	3000.00	Total
Aldeia	Bemetan	Count	5	2	3	3	1	2	1	1	0	18
		% within Aldeia	27.8%	11.1%	16.7%	16.7%	5.6%	11.1%	5.6%	5.6%	0.0%	100.0%
	Caihula	Count	3	4	3	5	2	0	2	1	0	20
		% within Aldeia	15.0%	20.0%	15.0%	25.0%	10.0%	0.0%	10.0%	5.0%	0.0%	100.0%
	Gourema	Count	0	1	0	1	0	0	0	0	0	2
		% within Aldeia	0.0%	50.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	Loro	Count	5	2	3	1	0	0	0	1	1	13
		% within Aldeia	38.5%	15.4%	23.1%	7.7%	0.0%	0.0%	0.0%	7.7%	7.7%	100.0%
	Raebutiudu	Count	5	1	0	1	1	2	0	0	0	10
		% within Aldeia	50.0%	10.0%	0.0%	10.0%	10.0%	20.0%	0.0%	0.0%	0.0%	100.0%
	Sara Ida	Count	10	2	2	2	1	0	1	0	0	18
		% within Aldeia	55.6%	11.1%	11.1%	11.1%	5.6%	0.0%	5.6%	0.0%	0.0%	100.0%
Total		Count	28	12	11	13	5	4	4	3	1	81
		% within Aldeia	34.6%	14.8%	13.6%	16.0%	6.2%	4.9%	4.9%	3.7%	1.2%	100.0%

Vegetable sales generated income for 40% of HH in Caihula between $200 and $305, 25% between $450 and $600, 20% up to $50, and 15% between $360 and $500. In addition, 5% of HH were able to make between $550 and $800, $900 and $1500. In comparison, 25% of HH made $450 to $600 from livestock sales, 20% made $80 to $200, 15% made up to $75, $250 and $600, 10% made $630 to $830, $1500 to $1800, and only 5% of HH were able to make between $1820 and $2000 from animal sales.

Revenue generated from the sale of vegetables, In Bemetan, 24% of HH made up to $50, between $120 and $180, 18% made between $60 and $100, 12% of HH made between $200 and $325, $360 and $500, and 6% made between $550 and $800, $900 and $1500. Income from the sale of livestock, 17% of HH made between $250 and $400, $450 and $600, 11% between $80 and $200, $806 and $1280, and 6% made between $1500 and $1800, $1820 and $2000, and 28% of HH made up to $75 from the sale of livestock.

Debt and exchange economy

For local rural households to meet their basic needs during hard times and to sustain agricultural production, they must have access to financial services through both formal and informal institutions, such as money lenders. According to data from the table 19, in Loro and Raebutiudu, 45% of HH have taken out loans or made credits, followed by Gourema 30%, Bemetan 23%, and Caihula 15%. The percentage of HH lending money, in contrast, only accounted for 15% for Loro, while Bemetan, Caihula, and Gourema each accounted for 10%, and in Saraida was less than 10%.

Table 19. Affirmation of credit and lending money

			Borrow/credit money	No	Yes	Total
Aldeia	Bemetan	Count	1	30	9	
		% within Aldeia	2.5%	75.0%	22.5%	100.
	Caihula	Count	0	34	6	
		% within Aldeia	0.0%	85.0%	15.0%	100.
	Gourema	Count	0	28	12	
		% within Aldeia	0.0%	70.0%	30.0%	100.
	Loro	Count	1	21	18	
		% within Aldeia	2.5%	52.5%	45.0%	100.
	Raebutiudu	Count	0	22	18	
		% within Aldeia	0.0%	55.0%	45.0%	100.
	Sara Ida	Count	0	33	7	
		% within Aldeia	0.0%	82.5%	17.5%	100.
Total		Count	2	168	70	2
		% within Aldeia	.8%	70.0%	29.2%	100.

			Landing money	No	Yes	Total
Aldeia	Bemetan	Count	1	35	4	
		% within Aldeia	2.5%	87.5%	10.0%	100.0
	Caihula	Count	0	36	4	
		% within Aldeia	0.0%	90.0%	10.0%	100.
	Gourema	Count	0	36	4	
		% within Aldeia	0.0%	90.0%	10.0%	100.
	Loro	Count	4	30	6	
		% within Aldeia	10.0%	75.0%	15.0%	100.
	Raebutiudu	Count	0	40	0	
		% within Aldeia	0.0%	100.0%	0.0%	100.
	Sara Ida	Count	0	37	3	
		% within Aldeia	0.0%	92.5%	7.5%	100.
Total		Count	5	214	21	2
		% within Aldeia	2.1%	89.2%	8.8%	100.

According to the information in the table 20, HH at study sites who require financial support can get it from a number of different places, including the bank, their family, a group or organization, Kaebauk, Moris Rasik, and Others (friends and neighbors). In Bemetan, 10% of the HH took out bank loans. While in Loro, the HH acquires loans with percentages of 15, 10, and 7 from Kaebauk, a group or association, and a bank. Moris Raisk provides loans to 8% of the HH in Caihula, and relatives provide loans to 5% of them. In comparison, 8% of HH in Gourema receive loans through Moris rasik, while 15% rely on family members for funding. For the HH in Raebutiudu, the loan was obtained through Kaebauk 15%, Group/Association 12%, and Family 8%. Unlike Saraida, where 8% of HH obtain loans from Moris Rasik. Loan interest rates range from 0% (no rate) to 20%.

Data also demonstrates that the majority of rural HH in the study site do not have access to formal financial institutions; only a very tiny proportion of the rural HH have access to bank financing. To help the rural HH, other private financial institutions like Moris rasik and Kaebauk, as well as association/group are required.

Table 20. The name of the lending institution

			Name of Financial Institutions						Total
			Bank	Family	Group	Kaebauk	Moris rasik	Other	
Aldeia	Bemetan	Count	31	4	1	0	2	1	1	40
		% within Aldeia	77.5%	10.0%	2.5%	0.0%	5.0%	2.5%	2.5%	100.0%
	Caihula	Count	34	1	2	0	0	3	0	40
		% within Aldeia	85.0%	2.5%	5.0%	0.0%	0.0%	7.5%	0.0%	100.0%
	Gourema	Count	27	1	6	1	0	3	2	40
		% within Aldeia	67.5%	2.5%	15.0%	2.5%	0.0%	7.5%	5.0%	100.0%
	Loro	Count	23	3	2	4	6	2	0	40
		% within Aldeia	57.5%	7.5%	5.0%	10.0%	15.0%	5.0%	0.0%	100.0%
	Raebutiudu	Count	23	0	3	5	6	1	2	40
		% within Aldeia	57.5%	0.0%	7.5%	12.5%	15.0%	2.5%	5.0%	100.0%
	Sara Ida	Count	33	1	2	0	0	3	1	40
		% within Aldeia	82.5%	2.5%	5.0%	0.0%	0.0%	7.5%	2.5%	100.0%
Total		Count	171	10	16	10	14	13	6	240
		% within Aldeia	71.3%	4.2%	6.7%	4.2%	5.8%	5.4%	2.5%	100.0%

11.1.6 Agriculture related issues

The issues facing rural farming communities are numerous (poor basic infrastructure, access to market, water availability, climate change, insurance, financial support, and other). Rural farmers' lives are affected by these difficulties in varying degrees.

Problems faced by farmers

The three primary issues that the rural agricultural community in the six research locations are dealing with are shown in the table below. Pests and weeds, climate change (including variations in rainfall volume and pattern), and strong winds are the three main issues listed.

Table 21. The top 3 challenges or problems faced by farmers across six study locations

			1st Main Problem			2nd Main Problem			3rd Main Problem	
			Pest including weeds	Change in climate condition (rain and temperature	Strong wind	Change in climate condition (rain and temperature	Pest and gulma	Strong wind	Pest including weeds	Change in climate condition (rain and temperature
Aldeia	Bemetan	Count	8	8	0	8	13	0	4	1
		% within Aldeia	20.0%	20.0%	0.0%	20.0%	32.5%	0.0%	10.0%	2.5%
	Caihula	Count	5	11	0	1	3	6	2	1
		% within Aldeia	12.5%	27.5%	0.0%	2.5%	7.5%	15.0%	5.0%	2.5%
	Gourema	Count	1	8	16	17	0	10	2	3
		% within Aldeia	2.5%	20.0%	40.0%	42.5%	0.0%	25.0%	5.0%	7.5%
	Loro	Count	17	2	0	5	10	0	5	2
		% within Aldeia	42.5%	5.0%	0.0%	12.5%	25.0%	0.0%	12.5%	5.0%
	Raebutiudu	Count	8	6	9	9	3	9	4	6
		% within Aldeia	20.0%	15.0%	22.5%	22.5%	7.5%	22.5%	10.0%	15.0%
	Sara Ida	Count	11	13	2	6	9	2	4	3
		% within Aldeia	27.5%	32.5%	5.0%	15.0%	22.5%	5.0%	10.0%	7.5%
Total		Count	50	48	27	46	38	27	21	16
		% within Aldeia	20.8%	20.0%	11.3%	19.2%	15.8%	11.3%	8.8%	6.7%

Despite the fact that only a small portion of HH made note of them, the following factors—irrigation systems, free-range animals, market access, funding, agricultural inputs, and training—have all increased the difficulties that rural farming communities must overcome.

Use of Agricultural inputs and Tractors

Having access to agriculture inputs such as pesticides, seeds and fertilizer are essential for improving the productivity and income of rural farming households. However, it is often difficult to access. Table 22, indicates that over 70% HH in the study location do not buy fertilizers. More than 20% of HH purchase fertilizer in Caihula and Raebutiudu, while only up to 5% did so in other study sites. Pesticide purchases were higher in Loro and Bemetan (45%), Caihula (25%), and Raebutiudu (10%), but not in Gourema and Saraida. Futhermore, seeds were identified to be the most often purchased item in Gourema and Caihula, with a percentage of 55% and 32%, respectively. Compared to other areas, which only made 20% purchases.

Table 22. HH access to/buy agricultural inputs

Aldeia			%HH buy fertilizer	Lae	Sim	%HH buy pesticides	Lae	Sim	%HH buy seeds	Lae	Sim
Aldeia	Bemetan	Count	3	35	2	3	20	17	4	33	3
		% within Aldeia	7.5%	87.5%	5.0%	7.5%	50.0%	42.5%	10.0%	82.5%	7.5%
	Caihula	Count	0	30	10	0	30	10	0	27	13
		% within Aldeia	0.0%	75.0%	25.0%	0.0%	75.0%	25.0%	0.0%	67.5%	32.5%
	Gourema	Count	0	38	2	0	40	0	0	18	22
		% within Aldeia	0.0%	95.0%	5.0%	0.0%	100.0%	0.0%	0.0%	45.0%	55.0%
	Loro	Count	0	37	3	1	21	18	0	36	4
		% within Aldeia	0.0%	92.5%	7.5%	2.5%	52.5%	45.0%	0.0%	90.0%	10.0%
	Raebutiudu	Count	0	31	9	0	36	4	0	32	8
		% within Aldeia	0.0%	77.5%	22.5%	0.0%	90.0%	10.0%	0.0%	80.0%	20.0%
	Sara Ida	Count	0	39	1	0	40	0	0	37	3
		% within Aldeia	0.0%	97.5%	2.5%	0.0%	100.0%	0.0%	0.0%	92.5%	7.5%
Total		Count	3	210	27	4	187	49	4	183	53
		% within Aldeia	1.3%	87.5%	11.3%	1.7%	77.9%	20.4%	1.7%	76.3%	22.1%

Owning or having access to farm equipment, such as tractors, can be tremendously beneficial to rural farming communities in supporting their agricultural operations and boosting output and productivity. Data on the table 23, however, shows that from 75% to 100% of HH at each of the six survey sites confirmed that they did not own a hand tractor. Saraida had the highest number of HH owners of hand tractors at 20%, followed by Bemetan and Loro at 18%, Caihula at 5%, and none (zero) in Gourema and Raebutiudu.

Table 23. Percentage of HH owned and rent hand tractors

Aldeia			Owned Hand Tractor	No	Yes	Total
Aldeia	Bemetan	Count	3	30	7	40
		% within Aldeia	7.5%	75.0%	17.5%	100.0%
	Caihula	Count	0	35	5	40
		% within Aldeia	0.0%	87.5%	12.5%	100.0%
	Gourema	Count	0	40	0	40
		% within Aldeia	0.0%	100.0%	0.0%	100.0%
	Loro	Count	3	30	7	40
		% within Aldeia	7.5%	75.0%	17.5%	100.0%
	Raebutiudu	Count	0	40	0	40
		% within Aldeia	0.0%	100.0%	0.0%	100.0%
	Sara Ida	Count	0	32	8	40
		% within Aldeia	0.0%	80.0%	20.0%	100.0%
Total		Count	6	207	27	240
		% within Aldeia	2.5%	86.3%	11.3%	100.0%

Aldeia			Renting tractors	No	Yes	Total
Aldeia	Bemetan	Count	3	16	21	40
		% within Aldeia	7.5%	40.0%	52.5%	100.0%
	Caihula	Count	0	23	17	40
		% within Aldeia	0.0%	57.5%	42.5%	100.0%
	Gourema	Count	0	40	0	40
		% within Aldeia	0.0%	100.0%	0.0%	100.0%
	Loro	Count	3	10	27	40
		% within Aldeia	7.5%	25.0%	67.5%	100.0%
	Raebutiudu	Count	0	40	0	40
		% within Aldeia	0.0%	100.0%	0.0%	100.0%
	Sara Ida	Count	0	29	11	40
		% within Aldeia	0.0%	72.5%	27.5%	100.0%
Total		Count	6	158	76	240
		% within Aldeia	2.5%	65.8%	31.7%	100.0%

Those HH without hand tractors have two alternatives for using tractors: they can rent from a private owner or receive government assistance through the Ministry of Agriculture and Fisheries. Farmers occasionally have access to tractors through organizations or associations they belong to.

According to the data from table 23, the rate of tractor rentals matches the percentage of tractor ownership. In comparison to Gorema and Raebutudu, who both had 0%, Loro and Bemetan had the greatest percentages of tractor rentals, with 68% and 56%. Renting tractors accounted for 43% and 28% in Caihula and Saraida HH, respectively. That may be due to the greater ability to rent a tractor in a location with greater tractor ownership.

Types of support expected

According to the data in the table 24, the three primary supports required by the community in the study locations are good quality seeds (28%), tractors (24%), and farm equipment (12%). When comparing the community expectations for support in each survey location, tractors are most needed in Loro (45%), Bemetan (38%) and Caihula (28%), followed by Saraida and Raebutidu with percentages 20% and 10. The only location where a tractor wasn't anticipated to be provided was Gourema (0%). On the other hand, Gourema's HH are expected to receive support in the form of seeds, with more than 70% of them. Support in form of seeds were also required by HH in Saraida 30%, Caihula 28%, Raebutiudu 23%.

In Raebutidu, HH anticipated receiving agricultural equipment the most (30%), followed by Gourema (13%), while Caihula, Loro, and Bemetan had the lowest expectations (3% and 8%, respectively).

Table 24. Types of support expected

Aldeia			Expected suport/assitance												Total
			Irrigation		Agriculture equipment	Seeds	Established group	Training	Planting trees	Not enggaed Agrc	Pesticides	Fertilizers	Gov Subsidies	Tractor	
Aldeia	Bemetan	Count	1	0	3	5	0	3	1	6	1	0	7	15	40
		% within Aldeia	2.5%	0.0%	7.5%	12.5%	0.0%	7.5%	2.5%	15.0%	2.5%	0.0%	17.5%	37.5%	100.0%
	Caihula	Count	10	0	1	11	0	3	0	0	0	3	2	11	40
		% within Aldeia	25.0%	0.0%	2.5%	27.5%	0.0%	7.5%	0.0%	0.0%	0.0%	7.5%	5.0%	27.5%	100.0%
	Gourema	Count	0	0	5	29	0	2	0	1	0	1	2	0	40
		% within Aldeia	0.0%	0.0%	12.5%	72.5%	0.0%	5.0%	0.0%	2.5%	0.0%	2.5%	5.0%	0.0%	100.0%
	Loro	Count	8	1	3	3	0	2	0	0	2	0	1	18	40
		% within Aldeia	20.0%	2.5%	7.5%	7.5%	0.0%	5.0%	0.0%	0.0%	5.0%	0.0%	2.5%	45.0%	100.0%
	Raebutiudu	Count	5	0	12	9	0	7	0	0	0	1	1	4	40
		% within Aldeia	12.5%	0.0%	30.0%	22.5%	0.0%	17.5%	0.0%	0.0%	0.0%	2.5%	2.5%	10.0%	100.0%
	Sara Ida	Count	5	1	4	12	1	2	0	0	1	2	0	8	40
		% within Aldeia	12.5%	2.5%	10.0%	30.0%	2.5%	5.0%	0.0%	0.0%	2.5%	5.0%	0.0%	20.0%	100.0%
Total		Count	29	2	28	69	1	19	1	7	4	7	13	56	240
		% within Aldeia	12.1%	.8%	11.7%	28.8%	.4%	7.9%	.4%	2.9%	1.7%	2.9%	5.4%	23.3%	100.0%

11.1.7 Comparative Analysis between four categories (A ,B, C and D)

The comparative analysis of each category of relative poverty/wealth using the categories/level of progress A B C D is provided in the following section for the six research sites. The analysis looks for characteristics and explains what causes each category's success and failure; to remain poor, become poor, escape out of poverty and stay non poor. Sociodemographic and income source are the main topics of the comparison analysis.

Main occupation by categories/level of progress

According to data collected from six study areas on the primary occupation of family heads based on progress level (A, B, C, and D), farmers accounted for 87% of category A's employment, while 6% worked at other paid jobs. Although farmers made up the majority of HH in category B (63%) there was a wider range of occupations, including civil servants (11%), business owners, and other paid positions (17%). The same pattern is seen for category D, which includes farmers (29%), government employees (25%), and other paid jobs (22%).

Table 25. Principal occupations by category

			Farmers	Advisor	Unemplo yed	Housewi fe	Member of local council & staff of Local NGO	Sivil Servant	Small business owner	Other work (koziñeiru/karpi nteiru/kondutor /peskador)	Volunter & contract staff	Total
							Principal ocupation					
Level of Progress	A	Count	90	0	1	6	3	0	0	3	0	103
		% within NivelProgresso	87.4%	0.0%	1.0%	5.8%	2.9%	0.0%	0.0%	2.9%	0.0%	100.0%
	B	Count	65	1	0	10	6	11	2	4	5	104
		% within NivelProgresso	62.5%	1.0%	0.0%	9.6%	5.8%	10.6%	1.9%	3.8%	4.8%	100.0%
	C	Count	4	0	0	0	0	0	0	1	0	5
		% within NivelProgresso	80.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	100.0%
	D	Count	8	0	1	6	1	7	1	2	2	28
		% within NivelProgresso	28.6%	0.0%	3.6%	21.4%	3.6%	25.0%	3.6%	7.1%	7.1%	100.0%
Total		Count	167	1	2	22	10	18	3	10	7	240
		% within NivelProgresso	69.6%	.4%	.8%	9.2%	4.2%	7.5%	1.3%	4.2%	2.9%	100.0%

With very little variations among other occupational categories, the data on the table showed that farmers predominated in categories A and C. The rural HH may be moved out of categories A and C if there is a greater variety of jobs available and employed. The alternative is to boost agricultural productivity in order to increase production and raise farmers' income.

Number of family and children enrolled at school

Comparing the number of family members in the HH for levels of progress (A, B, C, and D) reveals that there was little difference between category A, B, and D as they exhibit the same trend of having family members between four and six, with percentages of 47% and 39%, and the same trend of having family members between seven and nine, with category B (30%), category D (29%) and category A (26%), respectively. Further study is needed to define the idea of a large family and pinpoint the individual family members' contributions

to the HH economy in order to determine the relationship between family size and level of progress.

Table 26. Number of family in the HH based on the level of progress

			Number of family in the HH					Total
			1.00-3.00	4.00-6.00	7.00-9.00	10.00-12.00	13.00-15.00	
Level of progress	A	Count	22	48	26	6	0	102
		% within NivelProgresso	21.6%	47.1%	25.5%	5.9%	0.0%	100.0%
	B	Count	17	40	31	13	1	102
		% within NivelProgresso	16.7%	39.2%	30.4%	12.7%	1.0%	100.0%
	C	Count	2	1	2	0	0	5
		% within NivelProgresso	40.0%	20.0%	40.0%	0.0%	0.0%	100.0%
	D	Count	3	11	10	3	1	28
		% within NivelProgresso	10.7%	39.3%	35.7%	10.7%	3.6%	100.0%
Total		Count	44	100	69	22	2	237
		% within NivelProgresso	18.6%	42.2%	29.1%	9.3%	.8%	100.0%

As it relates to contrasting the proportion of children who are presently enrolled in school or a university between each progress level (A, B, C, and D). According to data from table 27, more than 20% of HH in categories A, B, and D have enrolled one child in school, with category A and B accounting for 31% of enrolment and category D for 23%. It was more common for category A (50%) to have two to three children enrolled in school, followed by category B (46%) and category D (32%).

Table 27. Number of children currently enrolled in school based on the level of progress

			Nu of children enrolled in school									Total
			.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	
NivelProgresso	A	Count	2	22	21	14	6	2	2	1	0	70
		% within NivelProgresso	2.9%	31.4%	30.0%	20.0%	8.6%	2.9%	2.9%	1.4%	0.0%	100.0%
	B	Count	0	25	21	16	9	4	2	2	1	80
		% within NivelProgresso	0.0%	31.3%	26.3%	20.0%	11.3%	5.0%	2.5%	2.5%	1.3%	100.0%
	C	Count	0	2	0	1	0	0	0	0	0	3
		% within NivelProgresso	0.0%	66.7%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	D	Count	0	5	3	4	4	5	1	0	0	22
		% within NivelProgresso	0.0%	22.7%	13.6%	18.2%	18.2%	22.7%	4.5%	0.0%	0.0%	100.0%
Total		Count	2	54	45	35	19	11	5	3	1	175
		% within NivelProgresso	1.1%	30.9%	25.7%	20.0%	10.9%	6.3%	2.9%	1.7%	.6%	100.0%

More HH in category D (45%), followed by A (26%) and B (23%), reported having four to eight children who are now enrolled in school. This might be evidence in favour of HH living a more stable life or economy in category D.

Source and value of income by HH in different level (A, B, C and D)

The HH's economic or financial stability will depend on the source and amount of its income. So it's crucial to know where the HH's money comes from and how much it contributes to the family's overall income. The information in the next section is based on the progress categories from the six research locations and pertains to the source of income and its value.

The different sources of income made by the HH under the different categories (A, B, C, and D) showed that HH in category A made much of their income from the sector of agriculture, livestock, and government subsidies (less diverse source of income), and for category C, the HH are more reliant on the agriculture sector and support from the family. In contrast to category B and D HH, the money gained comes from a variety of sources, such as agriculture, livestock, government subsidies, salary/paid job, and small businesses.

The HH in all categories to some extent all made an income from agriculture sector (Table 28), but the economic value gain is different comparing between the categories (A, B, C and D). Table below present the ranges of economic value made by HH in different categories from selling vegetables and livestock in the past three months prior to the survey (Table 29).

Table 28. Affirmation selling of vegetable products

| | | | Income from selling vegetables | | Total |
			No	Yes	
Level of progress	A	Count	42	61	103
		% within NivelProgresso	40.8%	59.2%	100.0%
	B	Count	42	62	104
		% within NivelProgresso	40.4%	59.6%	100.0%
	C	Count	3	2	5
		% within NivelProgresso	60.0%	40.0%	100.0%
	D	Count	14	14	28
		% within NivelProgresso	50.0%	50.0%	100.0%
Total		Count	101	139	240
		% within NivelProgresso	42.1%	57.9%	100.0%

The economic value from selling vegetables (Table 29), shows that HH in category A dominated in making the value ($) only up to $50, with a proportion of 48%. While this category made up 40% of income between $60 and $375.

In comparison to HH in category B, 35% of HH earned up to $50, 50% earned between $60 and $375, and more than 10% of HH in category B earned more than $375, compared to less than 6% in category A. In the case of category D, the economic value generated by selling vegetables is distributed uniformly with 23%, over the three value ranges (up to $50,

$60-$100, and $120-$200). In the three months preceding to the survey, 31% of HH in category D overall reported having earned more than $200.

Table 29. Economic value of selling vegetables

			Economic value of seling vegetables							
			2.50-50.00	60.00-100.00	120.00-200.00	240.00-375.00	400.00-550.00	750.00-900.00	1200.00-1500.00	Total
NivelProgresso	A	Count	25	9	12	3	1	1	1	52
		% within NivelProgresso	48.1%	17.3%	23.1%	5.8%	1.9%	1.9%	1.9%	100.0%
	B	Count	22	12	12	9	6	2	0	63
		% within NivelProgresso	34.9%	19.0%	19.0%	14.3%	9.5%	3.2%	0.0%	100.0%
	C	Count	1	0	1	0	0	0	0	2
		% within NivelProgresso	50.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	D	Count	3	3	3	2	1	0	1	13
		% within NivelProgresso	23.1%	23.1%	23.1%	15.4%	7.7%	0.0%	7.7%	100.0%
Total		Count	51	24	28	14	8	3	2	130
		% within NivelProgresso	39.2%	18.5%	21.5%	10.8%	6.2%	2.3%	1.5%	100.0%

Regarding income derived from selling livestock, data obtained indicates that the majority of HH in each of the four categories (A, B, C, and D) generate revenue through selling livestock to some level (Table 30). The percentage of HH income from selling cattle was found to be higher in categories B (44%) and D (39%) than in categories A (32%) and C (0%).

Table 30. Affirmation of selling livestock and their economic value

			Income from selling livestock		Total
			NO	Yes	
Level of progress	A	Count	70	33	103
		% within NivelProgresso	68.0%	32.0%	100.0%
	B	Count	59	45	104
		% within NivelProgresso	56.7%	43.3%	100.0%
	C	Count	5	0	5
		% within NivelProgresso	100.0%	0.0%	100.0%
	D	Count	17	11	28
		% within NivelProgresso	60.7%	39.3%	100.0%
Total		Count	151	89	240
		% within NivelProgresso	62.9%	37.1%	100.0%

While the majority of HH in categories (A, B and D) reported to make money from selling livestock, the economic value they add to HH earnings varied. Table 31 demonstrates that 50% of HH in category A earned up to $100 in income, 27% earned between $125 and $470, and 23% earned $500 and above. As opposed to category B which earned more from livestock: 36% of HH earning up to $75, 28% earning between $125 and $470, and a total of 31% of HH earning $500 and over.

Table 31. Economic value of selling livestock

			Economic value of selling livestock								
			up to 100	125.00-255.00	285.00-470.00	500.00-660.00	800.00-1000.00	1280.00-1670.00	1800.00	3000.00	Total
NivelProgr esso	A	Count	15	4	4	5	0	0	2	0	30
		% within NivelProgresso	50.0%	13.3%	13.3%	16.7%	0.0%	0.0%	6.7%	0.0%	100.0%
	B	Count	15	7	5	6	4	2	2	1	42
		% within NivelProgresso	35.7%	16.7%	11.9%	14.3%	9.5%	4.8%	4.8%	2.4%	100.0%
	D	Count	3	0	1	2	1	1	1	0	9
		% within NivelProgresso	33.3%	0.0%	11.1%	22.2%	11.1%	11.1%	11.1%	0.0%	100.0%
Total		Count	33	11	10	13	5	3	5	1	81
		% within NivelProgresso	40.7%	13.6%	12.3%	16.0%	6.2%	3.7%	6.2%	1.2%	100.0%

The use of Tractors

The use of a tractor to manage agricultural land can be very advantageous to farmers in terms of increasing agricultural productivity by saving labor, time, and money. Knowing which HH owned the tractors and having access to rental tractors may be crucial information for figuring out how to improve the quality of life for the rural farming community. The following table details the proportion of HH who own hand tractors and have access to renting tractors based on four categories (A, B, C, and D) across six survey areas.

Table 32. HH owned and have access to renting tractors under four categories

			Owned handtractor					If no Nor. Do you rent			
				No	Yes	Total			No	Yes	Total
Level of progress	A	Count	1	97	5	103	1		76	26	103
		% within NivelProgresso	1.0%	94.2%	4.9%	100.0%	1.0%		73.8%	25.2%	100.0%
	B	Count	3	83	18	104	3		64	37	104
		% within NivelProgresso	2.9%	79.8%	17.3%	100.0%	2.9%		61.5%	35.6%	100.0%
	C	Count	0	5	0	5	0		3	2	5
		% within NivelProgresso	0.0%	100.0%	0.0%	100.0%	0.0%		60.0%	40.0%	100.0%
	D	Count	2	22	4	28	2		15	11	28
		% within NivelProgresso	7.1%	78.6%	14.3%	100.0%	7.1%		53.6%	39.3%	100.0%
Total		Count	6	207	27	240	6		158	76	240
		% within NivelProgresso	2.5%	86.3%	11.3%	100.0%	2.5%		65.8%	31.7%	100.0%

Table data reveals that the percentage of tractors owned by HH in categories B and D was three times that of A, 17% and 14% respectively, compared to 5%. While no HH within category C owned tractors. Allowing access to tractors for agricultural labor in rural areas could significantly aid in the transition of HH from category A to B.

11.1.8 Conclusions and Recommendations

The result of this survey highlighted some key features of poverty and its relation to the agriculture sector's development, which has an impact on rural household quality of life. Based on the result obtain from this survey, it is concluded that:

- Local communities differ in their notions and perceptions of poverty from region to region and community to community.
- In order to address poverty issues locally, it is essential to comprehend the concept and characteristics of poor rural households from the community's perspective.
- Due to a variety of factors, including geography, the development of basic infrastructure, the variation in job opportunities, social and economic factors, poverty is distributed unevenly among the areas and communities.
- There was a wide range between locations of the proportion of households making income from agriculture, from 93% at Gourema to 20% at Saraida.
- There was a range between locations in the use of fertilizers and pesticides, and purchase of seed.
- Rural poor families rely mostly on the agriculture sector for their living, with minimal variation in their source of income.
- Families that have escaped or remain out of poverty have a greater current diversity of income sources
- Earning more income currently from vegetable sales and livestock sales correlates with escaping or remaining out of poverty
- Currently owning or having access to a 2-wheel tractor correlates with escaping or remaining out of poverty
- The creation of new work opportunities in rural areas and/or an increase in agricultural productivity can improve the quality of life for rural poor households.

In light of the results and experience gained from using the SoP in this study, it is advised that:

- Future projects that are related can use the information and data from this study as a jumping off point to monitor progress in the six study locations.
- The employment of SoP can act as a project monitoring and assessment tool

11.2 Appendix 2: Site characterisation

A. Southern rainfed livelihood zone

Southern rain fed livelihood zone is described as the area where more than 35% of community grow rice and more than 50% grow coffee. The system has a bimodal rainfall with much longer wet season that results in greater total rainfall. It is second to the highest population compared to other livelihood zones, yet agriculture system is less diverse and low specialized (Williams et al., 2010).

1.   LORO (BETANO, SAME - MANUFAHI) (5-25m altitude)

Loro is a hamlet of Betano village fall under southern rain fed livelihood zone. It covers 5 bairros with 275 households. In Betano, the land of Loro is known as the center for agriculture activities. Land ownership is communal, where farmers from other hamlet in Betano could own some piece of land in Loro to do farming. Farming activities happening in Loro include growing rice, maize, cassava, banana, papaya, mustard, eggplants, and some other high value crops like vanilla and cacao. The area previously had few hectares of paddy field, but mostly are being converted to maize field due to irrigation problem. Irrigation issue including intensive labor during land preparation has forced farmers to grow maize intercropping with other valuable vegetables and crops instead of rice. Although, there are quite different crops are grown, monoculture system is more common.

With a longer wet season, maize and rice are grown two times in a year, whereas vegetables and other crops are available all year round (Table 1). For communities that are living nearby coastal area, fishing is predominant which mostly happens from November to February where the tide is low. Animals being raised are cows, pigs, goat, and chicken, and are free roaming and free grazing.

Table 1. Seasonal calendar of Loro

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10
A. GROWING RICE												
Land preparation	1st						2nd					
Seedlings												
Transplanting												
Maintenance/management												
Harvesting												
B. GROWING MAIZE												
Land preparation	1st					2nd						
Planting												

Maintenance/management		🟩	🟩	🟩				🟢	🟢	🟢		
Harvesting					🟩	🟩					🟢	🟢
C. VEGETABLES												
Seedlings prep & Planting	Mustard eggplant					tomato						
Harvesting			Mustard eggplant						tomato			
D. FISHING	🟦	🟦	🟦	🟦	🟦							
E. CULTURAL												
Saubatar					🟧	🟧						
Lia moris/halo uma lisan										🟧	🟧	
F. WEATHER	raining	raining	raining	strong wind	raining	raining	flood	raining	raining	dry season	dry season	dry season

A quick on farm pH test conducted across Loro's area gives the picture that Loro's soil are mostly alkaline ranging from 8 to 9. However, the area is green and variety of crops and trees are grown with optimal condition.
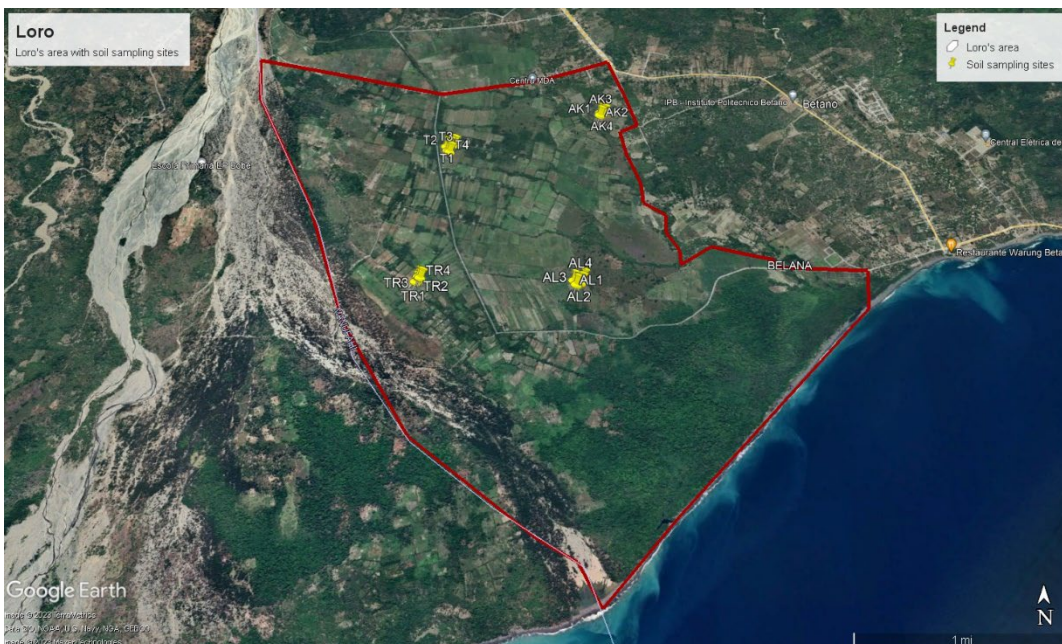
Picture 1. Loro's map within the red border line with yellow pin showing the area where soil sampling were taken and pH were tested.

Each household could own farmland ranging from 0.5 to 6 hectares. But with the bigger weeds grown, land preparation became difficult, as a consequence, some land is being abandoned with weeds taking over. Since Loro is the center for agriculture activities, farming in Loro quite labor intensive because it involves open farmland that has been covered by aggressive and perennial weeds. Farmers mostly rely on the use of herbicides or tractors to kill weeds, which otherwise has to be done manually with 10 people for 2 days in a hectare of land (with labor cost $5/person/day). However, current condition dictates abandoned land due to tractors malfunctioning (33 units supported by government but only 2 available now).

Market opportunity is good. Betano has been receiving collectors coming in and buying their produce, especially during COVID-19 pandemic as a result of TL government program, cesta básica. Current biggest intervention done by developing partners to aid soil fertility is the application of conservation agriculture system introduced by FAOTL. The project introduced farm management based on three principles; no burning, minimum tillage and application of mulch and cover crop such as, Lehe (velvet bean) to put back nitrogen into the soil. There are few options farmers could make use of lehe. One option is intercropping lehe with maize. By planting Lehe 6 weeks after maize plant has grown to cover the bare soil and suppress the weeds. After maize is harvested, lehe is let grown to pull down all the maize standing stalk and rolled down during land preparation to produce thick mulch, then ready for another planting cycle. Second option is, planting Lehe fully in one area as cover crop for the second cycle of planting. This rotation option works best for farmers with larger land area (e.g. 2 ha). To help rolled lehe, 2-wheel tractor were introduced.

Results of interview and focused group discussion (FGD) using Stages of Progress (SoP) and FGD in Rapid Rural Appraisal (RRA) draws some interesting summary of Loro's community. There are a lot of HH reliant on agriculture and mostly selling vegetables as the source of their income. Biggest problem farmers are facing is pests/weeds. Most household (HH) owns larger area for farming, therefore relying mostly to tractors to open/clear their land, hence are keen for tractor as support. The means of getting cash to response to emergency and to meet needs is by debt or some sort of savings and loan system. Compared to the other five chosen hamlets, Loro's agriculture practice is quite advance, as farmers are open to adapting to innovation such as the use of tractors, 2-wheel tractors (some even invent some spare parts for grading soils during land preparation, use of herbicides, good seed etc.). They are keen for tractors as support.

2.   BEE METAN (BETANO, SAME - MANUFAHI) (5-25m altitude)

Bee metan is another hamlet of Betano village, covering 5 bairros with 459 households. The hamlet is situated opposite to Loro and shared some borders and land with Loro. Although being the neighbor hamlet, the livelihood system in Bee Metan is quite different. Bee metan hamlet is the area where most institutions reside into, e.g. Institute of Polytechnique of Betano, the Electric

Centre, Betano Research Center, Clinic and Office of the Chief of Village, ect. (Pic. 2 map of Bee metan hamlet), as a result, interview findings during SoP process revealed that about 15% of the sample population are working off-farm and 20% get their main income from salary. Hence, making most HH less reliant on agriculture.

Picture 2. Bee Metan's map within the red border line with yellow pin showing the area where soil sampling were taken and pH were tested.

Similar to Loro, in terms of farming activities, Bee Metan farmers also grow rice, maize, cassava, banana, papaya, mustard, eggplants, and some other high value crops like vanilla and cacao, some are also starting to explore planting dragon fruits. Some of the farming areas were also previously paddy field. The conversation to maize field were due to irrigation and flooding problems. In contrast to Loro, soil sampling process showed that Bee Metan's farm contain soil that are harder and more compact. Coupled with limited availability of tractor from government, this has resulted of more land are being abandoned (difficult to seed unless freshly-tilled). Hence, result from SoP showed that community are keen to have tractor as support. Some of the timber trees available include teak tree, sandalwood, mahogany, *ai-sari* (perhaps *Cedrela toona*?). Bee Metan community mostly raised such as chicken, goat and cows, and lots of HH sell livestock. The Bee Metan community is less reliant on agriculture than Loro.

Table 2. Seasonal calendar of Bee Metan

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10
A. GROWING RICE												
Land preparation			1st				2nd					
Seedlings												
Transplanting												

	1	2	3	4	5	6	7	8	9	10	11	12
Maintenance/management				■	■	■		■	■			
Harvesting						■				■	■	
B. GROWING MAIZE												
Land preparation	■					2nd	■					1st
Planting		■	■				■	■				
Maintenance/management				■	■			■	■			
Harvesting					■					■	■	
C. VEGETABLES												
Seedlings prep & Planting							mungbean			Mustard kanko	Mustard kanko	Mustard kanko
Harvesting										Mustard kanko	Mustard Kanko	Mustard kanko
D. FISHING	■		■	■	■					■	■	■
E. CULTURAL												
Saubatar					■	■						
Lia moris/halo uma lisan										■	■	
F. WEATHER	raining	raining	raining	raining/ strong wind	raining	raining	flood	raining	raining	dry season	dry season	dry season

B. Upland high altitude livelihood zone

Upland high altitude livelihood zone is described as the area where at least 50% of community grow coffee and it is 1100 meter above sea level. The system has high amount of rainfall. It has a highest population density and second highest of total population. Community in this system has a focus on coffee and less diverse in other crops and livestock (Williams et. al., 2010).

3. RAEBUTI-UDO (MANUTASI-AINARO) (about 800m altitude)

Raebuti-udo is a hamlet belong to Manutasi village of Ainaro Villa. There are …. households. Despite the general description of the livelihood zones, farming activities in this hamlet level are quite diverse. Community grow rice, maize, horticulture crops, some high value crops such as coffee, vanilla and konjac. Raebuti-udo has a good access to spring water, running from Ramelau mountain, which is available throughout the year and very cold temperature. This is the water source they have for most of their farming activities. In contrast with the southern rainfed farming system, Raebuti-udo only do farm activities (rice, maize and horticulture) during the dry season, i.e. from April to October. This is because they have quite wet, windy and cold season from November to February. This condition causes slow growth of most crops, and causes lodging and causes vegetables to rot quickly before harvest, therefore farming is avoided during these months, consequently shortage of food supply is more common.
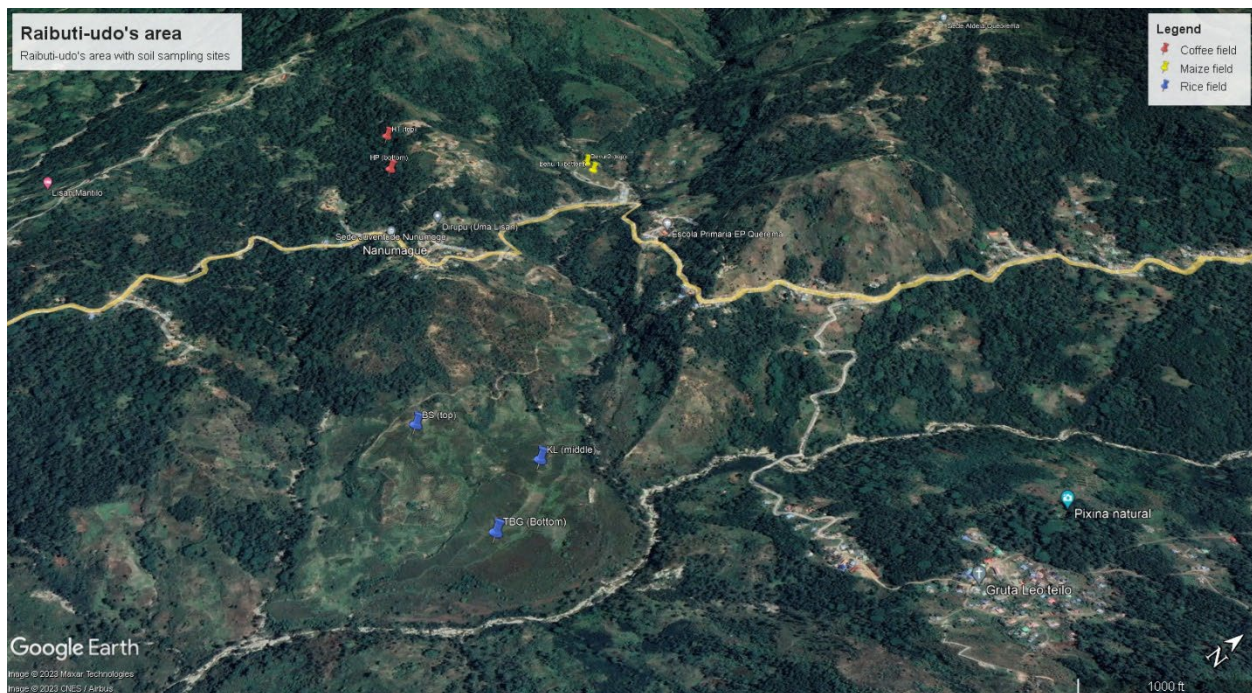
Picture 3. Raebuti-udo's map showing the area where soil samples were taken and soil pH tested.

Table 3. Seasonal calendar of Raebuti-udo

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10
A. GROWING RICE												
Land preparation												
Seedlings												

Transplanting								🟩				
Maintenance/management						🟩	🟩	🟩				
Harvesting	🟩											
B. GROWING MAIZE												
Land preparation										🟩	🟩	
Planting	🟩											🟩
Maintenance/management		🟩	🟩									
Harvesting				🟩	🟩							
C. VEGETABLES												
Seedlings prep & Planting						🟩	🟩	🟩	🟩	🟩	🟩	🟩
Harvesting						🟩	🟩	🟩	🟩	🟩	🟩	🟩
D. AQUACULTURE	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
E. CULTURAL												
Saubatar/Sau-cafe			🟧	🟧	🟧							
Lia moris/halo uma lisan										🟧	🟧	🟧
F. WEATHER	raining	raining	raining/ strong wind	raining/ strong wind	raining/ strong wind	Mode rate rain	Mode rate rain	Mode rate rain	Mode rate rain	dry season	dry season	raining

Communities in Raebuti-udo identified labour supply/productivity, weeds (especially mist flower), soil fertility, pest and diseases as problems in their farming system. Farmers would plough their land for rice production just enough for consumption. With traditional system, they could prepare just enough land, where 1 ha of land will give yield to about 1 ton of rice. Communities questioned whether this has to do with the soil fertility and they understand this as 'vitamins' in the soil.

Mist flowers (local name: 'du'ut birima') has been growing aggressively since year of 2000. The aggressiveness of this weed had covered most of the grazing areas, making fodder is limited for the animals particularly during dry season. The weed is also claimed to be a tripping hazard to the farmers when working in their farm.

In terms of natural resources, Raebuti-udo has spring water available all year round. Thus, based on their seasonal calendar, farming mostly happen during dry season because being in a high altitude, that's where the temperature and sunlight are most favorable. In the areas near the paddy field, some irrigation scheme was established by MAF since 2015. Communities characterized different soil type in Raebuti-udo as rai mean (red soil), rai metan (black soil – which mostly considered as healthy soil), rai fatuk (stony soil) and rai dodok (muddy soil). In these soils, communities grow different variety of crops, i.e., maize, mustard, cassava, banana, kale, lettuce, vanilla, coffee, and rice. There are also few timbers, casuarina, *Albizia procera*, black eucalyptus. Animals raised included bali cow, Timur cow, horse, chicken, and goat. *Tara bandu*, a local rules and regulations established by the local clan, is very strong in this community. During farming season, community are obliged to keep their animals away from the farm areas otherwise sanction will be applied accordingly.

Similar to Loro and Bee Metan, labour is still an issue being raised. For example, in Raebuti-udo, irrigation system is lacking outside of the paddy field area. As a consequence, community has to carry water with basket to water their vanilla farm which normally ranging from 0.5 ha up. Land preparation for paddy field is done manually, by ploughing with hoe. With the steep slope area that they are, it is discouraging for community to farm more than what they can manage. Recent intervention so far around Raebuti-udo includes SAPIP and KALIB project. SAPIP is a government-led program funded by World Bank. In Manutasi their intervention is more on aquaculture and post-harvest, coffee processing. Whereas KALIB is on coffee management (pruning).

Results from SoP in Raebuti-udo revealed that community in Raebuti-udo are less reliant on agriculture than Gorema. Biggest problem farmers are facing is strong winds. The means of getting cash to response to emergency and making ends meet are by debt or some sort of savings-and-loan system. With the weed infestation problem that minimize the availability of fodder for livestock, low yield in rice and coffee, and shortage of food during wet season, community are keen with agriculture projects for support. They are keen for agricultural implements as support.

4. GOREMA (MAUBISSE – AINARO) (about 1800m altitude)

Gorema is a hamlet of Horai-quick village with 30 minutes' drive from Maubisse city center. The area is about 34 kilometers from Dili. Road condition is challenging, particularly during rainy season. There are …. household living in Gorema. The hamlet is divided into 3 community group, i.e., St. Inacio 2 situated at the top of the hamlet, St. Marcelino – middle part and Sagrada Familia – bottom area of the hamlet (picture 4).

The SoP revealed that the Gorema community is very reliant on agriculture and mainly produce vegetables. The RRA process revealed that they (at least those in the FGD) would prefer extra on-farm productivity over more community members going away for work.

Gorema has two springs where water is available all year round. The area has potential for horticulture, growing carrots, mustard, beans, cabbage, potatoes, stone fruits, maize, soya bean, sweet potato, onion, garlic, bombay, chayote, other root crops and small scale of coffee. The most timber grown there is black eucalyptus, though it is a secondary natural forest. Animals raised include bali cow, timur cow, goat, pig, horse, chicken, fish, duck and dove.

Picture 4. Gorema's map showing the area where soil samples were taken and soil pH tested. Yellow mark is St. Inacio 2, red is St. Marcelino and pink is Sagrada Familia.

Gorema community identified their soil type as rai mean (red soil), rai mean fatuk (stony red soil), rai kinur (yellow soil), rai metan (black soil), rai henek (sandy soil) and rai manu ten (soil that looks like the dirt of chicken). Farming in this area is already challenging due to its slopey nature. During the RRA discussion, community highlight the challenge in labour. Slopey area makes it impossible for a machine to operate on steeper slopes, hence, land preparation is done there manually with hoe. Planting of vegetable and carrots seeds are done by broadcasting and women has to sit all day long to pick out smaller weeds that are growing side by side with their carrot seedlings that they broadcasted. This is all the more difficult, as the manual weeding seems to have selected in favour of a weed that looks a lot like carrots. With all these efforts, community claimed that yield is not much compared to before; could it be nutrition, weeds, something else? Farmers somehow know to spot crops that are not going to give favorable yield (Picture 5).

Picture 5. Mix farming of beans and carrots in Gorema. One farmer pointed this field and said, this is an example of when they know it's not going to give good yield when the leaves turn yellow. This looks suspiciously like N deficiency.

So far, Red Cross established a few water stations within the three-community group but some stations are no longer functioning. Red cross also introduced SALT technology, terracing and plastic mulching but community claimed that after the project, they could not continue because they could not access to the materials easily. Farmers here are keen for seed supply as support.

Table 4. Seasonal calendar of Gorema

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10
A. GROWING MAIZE/BEANS/VEGIES												
Land preparation			1st							2nd		
Planting												
Maintenance/management												
Harvesting												
D. CULTURAL												
Saubatar/Sau-cafe												
Lia moris/halo uma lisan												
E. WEATHER	raining	raining/ strong wind	raining/ strong wind	raining/ strong wind	raining/ strong wind	Moderate rain	Moderate rain	dry season	dry season	dry season	cold	cold

NB: maize only one season at the second cycle.

C. Mid-altitude irrigated livelihood zone

The mid-altitude irrigated livelihood zone is described as the area where less than 35% of community grow rice. The HH in this system focus their agriculture on rice production but there is also diversity of crops and livestock, especially high in buffalo (Williams et. al., 2010).

5. SARAIDA (BAGUIA, QUELICAI) (800m altitude)

Saraida is a hamlet of Baguia suku located at the mid area of the Quelicai post administrative of Baucau. Saraida hamlet has two bairros i.e., Saraida vila and Saraida. There are ….. number of household and the hamlet is one hour drive away from the city center of Baucau. The road condition

is challenging however, road construction is underway and is expected to be complete by next year (2024). This road will connect Quelicai to Ossu and other major town in Baucau passing by Saraida. This opens market opportunity to Saraida and the sukus around them.

Saraida's main water source is spring water. In general, water availability is good however, water distribution (canalization or irrigation) is not well managed thus, often becoming an issue for the community. Saraida has a great potential for growing rice as there are several large areas for paddy field, that grow white, red and black rice.   A proportion of the paddy fields no longer grow rice, allegedly due to the owners pursuing other activities. In addition, community also do farm maize, fruit trees, root crops and horticulture (vegetables such as lettuce, mustard, eggplants etc.). Animals raised include cattle, buffalo, goat, pig, horse, chicken, and fish.

There is very limited knowledge on the use of herbicides, e.g. roundup, which is very common in Loro and Bee Metan hamlets of Betano. They are open to using herbicides, but wary of them for safety and environmental reasons.

Picture 6. Saraida's map showing the area where soil samples were taken (all paddy field except sampling number 4) and soil pH tested.

Few interventions by government and development partners are there. The PNDS project (Government project for development in village level) is now operating in Saraida particularly irrigation scheme. PLAN international also working at the same program, water project. FAO through the pro resilience project on the adoption of velvet bean for cover crops and the concept of conservation agriculture is also implementing in Saraida. There is a long existing women's group that are very involved and creative in farming. Many farmers want seed supplied as support.

Table 5. Seasonal calendar of Saraida

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10

	1	2	3	4	5	6	7	8	9	10	11	12
A. GROWING RICE												
Land preparation			▉	▉								
Seedlings			▉	▉								
Transplanting			▉	▉								
Maintenance/management				▉	▉	▉	▉					
Harvesting								▉	▉			
B. GROWING MAIZE												
Land preparation										▉	▉	▉
Planting	▉	▉										
Maintenance/management		▉	▉	▉								
Harvesting					▉	▉						
C. VEGETABLES												
Seedlings prep & Planting	▉						▉		▉		▉	
Harvesting		▉					▉		▉		▉	
E. CULTURAL												
Saubatar					▉	▉						
Sauhare										▉		
Lia moris/halo uma lisan	▉											▉
F. WEATHER	bailoron	udan	udan	Udan Anin boot	Udan Anin boot	Udan Anin boot	udan	Udan natoon	bailoron	Bailoron Anin boot	Bailoron Anin boot	bailoron

During the RRA discussion, community express their difficulties in growing rice which mostly is done with conventional style/manual. There are two hand tractors available but that is not enough to support the work. Rice cultivation system is normally done by land preparation to remove the weeds then follow by broadcasting the seeds and let it grow. Sometimes weed management is not done, thus rice is competing with weeds and not yielding good results and even lower. Although community has been growing rice for years, the variety of seeds (white, black and red rice) that

are being used are not known. Few varieties are said to be since the Portuguese time, R5, R8 (short variety) and some local name, Samaresa, Silau, Kailaresa, Uaiimi and Durakau. There are some recent varieties being introduced, e.g. Nakroma, but claimed not given good yield. Farming in maize field is similar, weed had been the most frustrating issues among farmers. Some community said soil fertility is another issue. Transplanting is being avoided in rice as it is too costly. Farmers seem to be reluctant to use inorganic fertilizers in their farming system. One farmer said they did use urea before (at an unknown rate), the result was great but then they observe that their soils turned harder/compact.

Results from SoP in Saraida revealed that community do receive lots of support from government, and there is little reliance on agriculture. Aside from off-farm work, some community do sell vegetables and quite a few livestock. Community is aware of the changing in weather pattern, but also identify weeds and pest as a big problem in their farming system and 1/3 of the HH requested seed as support.

6.   CAIHULA (UMA-ANA-ULO, VENILALE) (800m altitude)

Caihula is a hamlet of Uma-Ana-Ulo suku located at the mid area of the Venilale post administrative of Baucau. There are ….. number of household and the hamlet is forty-five minutes' drive away from the city center of Baucau. The road condition is good with the current road construction underway.

Canal irrigation is running through most of the Baucau's villages including Caihula. Similar to Saraida, Caihula has a great potential for growing rice as there are several large areas for paddy field. Like Saraida, rice varieties mostly used are R6 (short and fast grown), R8, and Silau. Additionally, community also do farm maize, fruit trees, root crops and horticulture (vegetables such as lettuce, mustard, eggplants etc.) and a number of timber tree including sandalwood trees. Animals raised are cow, buffalo, goat, pig, horse, chicken, and fish. Similar to most of the farming system in Timor-Leste, farming is labor intensive with low yield. Rice is planted by broadcasting when community feels like water/rain will be limited, in contrast, transplanting will be applied when water/rain is abundance, as this technique will yield more good result. During the focus group discussion, community expressed their interest more in growing rice than maize as the staple crop due to consumption preference.

Labor division is quite obvious with women doing tasks that are considered as not-physically demanding such as collecting rice seedlings, transplanting and harvest. However, this process needs about 10 people to do for about 2 to 3 days in a hectare of land. Men would often do the labor-intensive work such as open new land, ploughing, leveling and clearing hard and more rooted weeds. These types of work are expressed as the hardest or labor-intensive work. Caihula's community at times tried to increase their yield by putting inputs into their cropping system such as using inorganic fertilizers and sometimes urea particularly when growing vegetables such as cabbage and mustard. There is very limited knowledge on the use of herbicides, e.g. roundup, which is very common in Loro and Bee Metan hamlets of Betano. They are open to using herbicides, but wary of them for safety and environmental reasons.

Results from SoP in Caihula revealed that lots of community are reliant in agriculture activities as their main source of income. That is expressed as many HH sell vegetables and livestock. Similar

to Saraida, community are aware of the changing in weather pattern, but also identify weeds and pest as a big problem in their farming system. In general, 1/3 of HH buy inputs for their agriculture, particularly seed, hence requested seed as support.

Picture 6. Caihula's map showing the area where FGD was held.

Table 6. Seasonal calendar of Caihula

Activities	Months											
	11	12	1	2	3	4	5	6	7	8	9	10
A. GROWING RICE												
Land preparation	🟩	🟩	🟩									
Seedlings	🟩	🟩	🟩									
Transplanting			🟩	🟩	Late							
Maintenance/management				🟩	🟩	🟩	🟩					
Harvesting								🟩	🟩	🟩		
B. GROWING MAIZE												
Land preparation										🟩	🟩	🟩
Planting	🟩	🟩										

Maintenance/management			🟩	🟩	🟩							
Harvesting					🟩	🟩						
C. VEGETABLES	Throughout the year as long as there is water available											
Seedlings prep & Planting												
Harvesting												
E. CULTURAL												
Saubatar					🟩	🟩						
Sauhare										🟩	🟩	
Lia moris/halo uma lisan												
									🟩	🟩	🟩	
F. WEATHER	bailoron	udan	udan	Udan Anin boot	Udan Anin boot	Udan Anin boot	udan	Udan natoon	bailoron	Bailoron Anin boot	Bailoron Anin boot	bailoron

11.3 Appendix 3: Food Security Report

NATIONAL UNIVERSITY OF TIMOR LOROSA'E
FACULTY OF AGRICULTURE

EVALUATION OF LIVELIHOOD ZONES, RURAL HOUSEHOLD TRAJECTORIES, RESEARCH AND DEVELOPMENT PARTNERS AND INITIATIVES IN TIMOR LESTE: ACIAR SLAM/2021/108

SECTIONS OF

FOOD SECURITY OF RURAL FARMING COMMUNITIES IN THREE DIFFERENT LIVELIHOOD ZONES IN TIMOR-LESTE

PREPARED BY

Matias Tavares, PhD; Vicente de Paulo Correia, PhD; Oscar da Silva, MSc; Bernardo Leto, MPhil

DILI, 2023

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11.3.1 Researchers and Research Design

This section of the report includes descriptions of the study team members, sample, and site selection process.

Researchers

Four researchers, three from the Faculty of Agriculture and one from the Faculty of Social Science, made up the research team from the National University of Timor-Lorosa'e. One enumerator from the Faculty of Agriculture UNTL's final year as well as twelve field research guides, one from each study location, supported the research team.

Researchers:

- Matias Tavares, PhD (Agriculture Faculty, Research Coordinator)
- Vicente Paulo de Correia, PhD (Agriculture Faculty, Team Member
- Oscar da Silva (Agriculture Faculty, Team Member)
- Bernardo Leto (Faculty of Social Science, Team Member)

Enumerator and research guides:

- Jaime da Silva Gomes (Faculty of Agriculture/UNTL)
- Marcia da Silva (SRA team)
- Juvita Pereira (Manufahi/Same/Betanu/Loro)
- Orlando M. dos Santos (Manufahi/Same/Betanu/Loro)
- Bendito Oranai (Manufahi/Same/Betanu/Bemetan)
- Dina Maria Nunes (Manufahi/Same/Betanu/Bemetan)
- Liliana da Silva (Ainaro/Ainaro vila/Manutasi/Raebutiudu)
- Alipo da Cruz (Ainaro/Ainaro vila/Manutasi/Raebutiudu)
- Augosto da C. Dasilva (Ainaro/Maubisse/Horaikiik/Gourema)
- Abril Pires (Ainaro/Maubisse/Horaikiik/Gourema)
- Aquelina Ximenes (Baucau/Venilale/Uma Ana Ulo/Cai-Hula)
- Sebastiao B. Belo (Baucau/Venilale/Uma Ana Ulo/Cai-Hula)
- Felix N. A. Da Conceicao (Baucau/Quelicai/Baguia/Saraida)
- Albertina Ximenes (Baucau/Quelicai/Baguia/Saraida)

Study Design

Participants in the food security survey were largely the same as those who took part in the Stages of Progress (SoP) survey, which was part of the implementation of the SoP. A total of 240 respondents from all six study locations were recruited as participants for the food security survey (40 HH from each study location). In order to get more specific information on the food security issues. The following topics are covered by the questions created for this survey:

D) Typical meals of the HH or the community

E) The status of food security and sufficiency

The survey's questions in detail are as follows:

- ☐ What is a typical meal in your community?
- ☐ In the last year (2022) did your family / household worried that they did not have enough food?
- ☐ In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means?
- ☐ In the last year (2022) did your family / household ever been forced to eat food that was unsuitable to eat?
- ☐ In the last year (2022) did your family / household ever reduced food portion size because of inadequate means?
- ☐ In the last year (2022) did your family / household ever reduced the number of times a day they eat (from 3 times to 2 times – for example) because they were unable to provide more
- ☐ In the last year (2022) did your family / household had no food to eat in the house?
- ☐ In the last year (2022) did your family / household went to bed hungry at night because there was no food?
- ☐ In the last year (2022) did your family / household were unable to eat for one whole day?

Sampling Strategy

Three municipalities, Manufahi, Ainaro and Baucau were selected to represent three distinct livelihood zones; the Mid-altitude irrigated zone (Livelihood Zone 2), the High elevation upland zone (Livelihood Zone 5), and Southern rain-fed zone (Livelihood Zone 7).

Six aldeias were chosen from among these three municipalities, and they are as follows (Table 1). Livelihood Zone 5 is represented by Raebutiudu and Gourema (Ainaro); Livelihood Zone 7 is represented by Loro and Beemetan (Manufahi); and Livelihood Zone 2 is represented by Cai-Hula and Saraida (Baucau). Timor-Leste is divided into seven livelihood zones[4]: the Northern rain-fed zone, the Southern rain-fed zone, the Mid-altitude irrigated zone, the South coast irrigated zone, and the Mid-elevation upland zone (Figure 1)
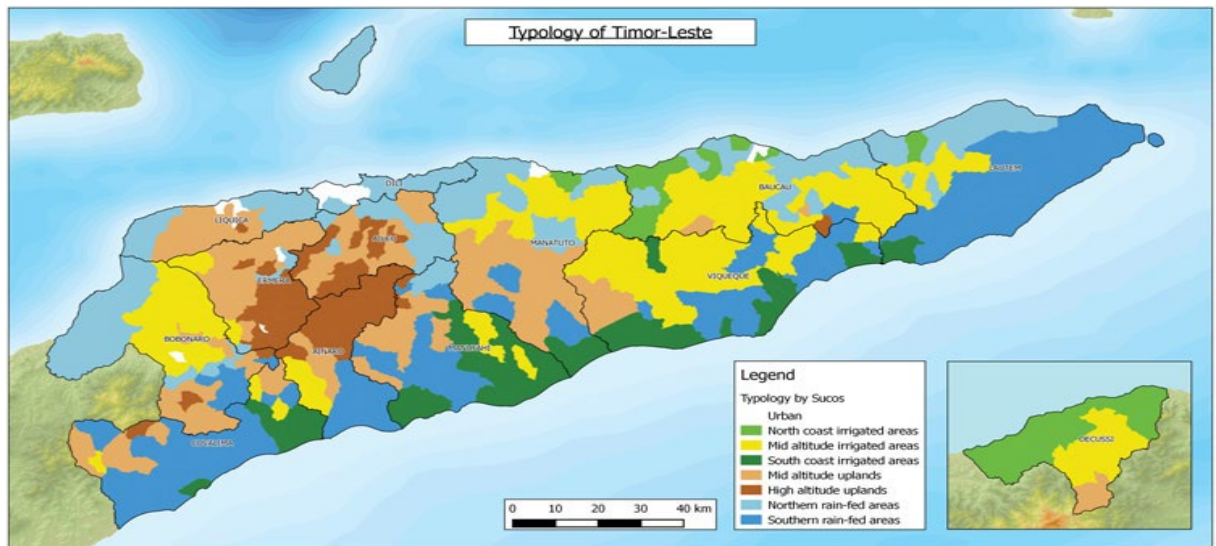
Figure 1. Map of Livelihood Zone in Timor-Leste

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[4] *Williams, R.L., Bacon, S., Ferreira, A. and Erskine, W., 2018. An approach to characterise agricultural livelihoods and livelihood zones using national census data in Timor-Leste. Experimental Agriculture, 54(6), pp.857-873.*

Table 1. Livelihood Zone, Study sites and Number of HH Interviewed

Livelihood Zone	Districts	Subdistrict Targeted	*Sucos/Aldeias* Targeted	Households Interviewed
2 **Mid-altitude irrigated zone**	Baucau	Venilale	Uma Ana Ulu/ Cai-Hula	40
		Quelicai	Baguia/Saraida	40
5 **High elevation upland zone**	Ainaro	Ainaro Vila	Manutasi/Raebutiudu	40
		Maubisse	Horaikiik/Gourema	40
7 **Southern rain-fed zone**	Manufahi	Same Vila	Betano/Loro	40
			Betano/Bemeetan	40

11.3.2 Introduction to food security survey

Household staple food consumption and its diversification can be a helpful indicator of food availability, affordability, and accessibility for the rural agricultural community, which can help to determine the nutritional status of the HH and the community. Additionally, a wider variety of foods consumed can be a reliable sign of household prosperity. Following the implementation of the Stages of Progress (SoP), we sought to establish the general status of qualitative data linked to food security in the six study locations by conducting this survey. It is acknowledged that the quality of the diet or food consumed must be calculated or taken into consideration in order to obtain a more thorough understanding of the nutritional condition of the community.

11.3.3 Findings

The results of the food security survey are reported for each of the six research locations, which correspond to Timor-Leste's three livelihood zones: the southern rainfed zones, the high-altitude uplands, and the mid-altitude irrigated areas. The general household information in each research site is covered in the first section, which is then followed by the typical foods consumed and analysis of HH's current food security situation in each study location.

Aldeia Loro, Manufahi

General Household Information

12.5% of the 40 HH respondents in aldeia Loro, suco Betano, were female, compared to 87.5% of the men. The respondents' ages range from 32 to 80. The majority of respondents (70%) work as farmers, followed by housewives and civil servants (10%), while the remaining 20% are divided among fishermen, suco council members, advisors, and non-governmental organization employees. In terms of poverty status or Stages of progress (SoP)[5], the forty HH interviewed for this study were classified as follows: 65% of the HH identify as category B (escape from poverty), 25% as category A (remaining poor), 1% as category C (falling into poverty), and 2% as category D (remaining not poor).

Typical food consumed and food security status in Aldeia Loro

Food security status (food availability, affordability, accessibility, and nutritional status) can be evaluated by looking at the typical and diverse foods that a household or community in a rural location consumes.

We asked a straightforward question in this survey, "What is a typical meal in your household/community?" The five primary usual foods for the HH and the community in aldeia Loro were found to be rice (97.5%), corn (72.5%), banana (52.5%), casava (47.5%), bread (30%).

Table 2. Typical food consumed by the HH/community in aldeia Loro

Typical food consumed	Frequency	Percent
Rice/Foos	39	97.5
Corn/Batar	30	75.0
Banana/Hudi	25	62.5
Casava/Aifarina	24	60.0
Bread/Paun	12	30.0

When the respondents were asked to confirm their concerns about not having enough food, "In the last year (2022), "Did your family / household worried that they did not have enough food?" In response to this question, 75% of HH in aldeia Loro said they were not concerned about not having enough food in the previous year, while only 25% of HH said they were concerned about not having enough food to feed the family.

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[5] *See SoP report 'Evaluation of livelihood zones, rural household trajectories, research and development partners and initiatives in Timor-Leste: ACIAR SLAM/2021/108*

The 25% of HH who worried about not having enough food further confirms that the sense of unease might occur one to three times. Age-related problems (too elderly to work) are one of the causes of the worries.

Responded to a question, In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? A small percentage, 17.5% of respondents, claimed that they occasionally (less than four times) were unable to eat typical meals because of a lack of income, with 82.5% of respondents verifying that this was not the case. Furthermore, the respondents were asked, In the last year (2022) did your family / household ever been forced to eat food that was unsuitable to eat? (i.e because they have not been able to obtain other/better kinds of food). Only 12.5% of respondents said they had encountered the condition 1-3 times, while 87.5% said they had never encountered that condition.

Additionally, 97.5% of respondents in the aldeia Loro in 2022 reported having no experience with reducing food portions, frequency of meals, running out of food at home, going to bed hungry at night, or going without food for a whole day.

Aldeia Bemetan, Manufahi

General Household Information

The forty respondents who were interviewed in aldeia Bemetan, suco Betano, made up of 50% women and 50% men. Respondents' ages range from 23 to 81. Farmers make up the majority of responders (55%), followed by civil servants (20%), housewives (12.5%), fishermen and small business owners making up the remaining 10%. Regarding Stages of Progress (SoP), the forty HH interviewed in this survey, 37.5% of the HH identify as category B (Escaping poverty), 5% as category A (Remaining poor), 2% as category C (Falling into poverty), and 50% as category D (Remaining not poor).

3.2.2 Typical food consumed and food security status in aldeia Bemetan

Household typical and diversified food consumed by the household or community in the rural areas can be a good indicator to food availability, affordability as well as its accessibility and the nutritional status. In this survey we posed a simple question "What is a typical meal in your household/community" From a total of 40 HH interviewed in aldeia Bemetran, it was identified that the the five main typical food for the HH and the community in aldeia Bemetan consisted of rice (97.5%), corn (90.5%), banana (77.5%), casava (70.0%), potatoes (15%).

Table 3. Typical food consumed by the HH/community in aldeia Bemetan

Typical food consumed	Frequency	Percent
Rice/Foos	39	97.5
Corn/Batar	36	90.5
Banana/Hudi	31	77.5
Casava/Aifarina	28	70.0
Potatoes/Fehuk	6	15.0

When the respondents were asked to confirm their worries about not having enough food 'In the last year (2022), 'Did your family / household worried that they did not have enough food? In response to this questions, the majority of respondents, 67.5%, acknowledged that they were concerned about not having enough food to feed their family, while 32.5% of respondents in aldeia Bemetan said they were not concerned about not having enough food in the previous year.

From a total of 67.5% of HH who were concerned about food deficiency, 7.5% of respondents said the sensation of unease occurred more frequently more than ten times,

while 60% said it occurred less frequently than four times. Some of the causes of the anxiety include the occurrence of extreme weather, such as strong winds, too much rain, and big waves, as well as age-related problems (those who are too elderly to work).

in response to a question, In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? Only 20% of respondents said they were unable to eat regular meals because of a lack of resources, with 80% of respondents confirming that this was not the case, and it typically happened during rainy sessions.

Furthermore, when the respondents were asked, In the last year (2022) did your family / household ever been forced to eat food that was unsuitable to eat? (i.e because they have not been able to obtain other/better kinds of food), 80% said they had not experienced this condition, and just 20% said they had once to three times throughout the previous year.

In regards to cutting food portions, 72.5% of respondents in aldeia Bemetan said they had never experienced this, while 27.5% said they had done so because of inadequate food due to a lack of money, receiving money late, and unfavorable weather conditions (May-June).

Along with reducing food portions, 20% of respondents admitted that they occasionally had to reduce how often they ate throughout the day-by no more than four times. However, nearly all of the respondents (99%) did not have the experience of being without food in the house and unable to eat for a full day. 10% of those surveyed admitted that occasionally, one or more members of the family in the home went to bed hungry at night.

Aldeia Raebutiudu, Ainaro

General Household Information

37.5% of the 40 HH respondents who were interviewed in aldeia Raebutiudu, suco Manutasi were female, while 62.5% were male. Respondents' ages range from 32 to 90. The majority of respondents (60%) work as farmers, followed by housewives (22.5%), civil servants (10%), and others (7.5%), who are primarily employed as drivers, suco council members, and volunteers. In terms of the Stages of Progress, respondents in Aldeia Raebutiudu were divided into the following categories: 52.5% fell under category B (Escaping poverty), 45%

fell under category A (remaining poor), 2.5% fell under category C (falling into poverty), and 0% fell under category D (remaining not poor).

Typical food consumed and food security status in aldeia Raebutidu

In this survey we posed a simple question "What is a typical meal in your household/community" From a total of 40 HH interviewed in aldeia Raebutiudu, It was determined that the five typical foods for the HH and the community in aldeia Raebutiudu consist of corn (82.5%), casava (80%), rice (75%) and taro (65%) and potatoes (27.5%).

Table 4. Typical food consumed by the HH/community in aldeia Raebutiudu

Primary food consumed	Frequency	Percent
Corn/Batar	33	82.5
Casava/Aifarina	32	80.0
Rice/Foos	30	75.0
Taro /Talas	26	65.0
Potatoes/Fehuk	11	27.5

The question "In the last year (2022), did your family or household worry that they did not have enough food?" was asked to validate their concerns about running out of food. Responding to this question, 90% of respondents in aldeia Raebutiudu said they were concerned about not having enough food in the previous year, while just 10% of HH said they were not concerned about not having enough food to feed their families.

When asked how often they felt worried, 72% of respondents said that it happened only occasionally-less than four times while 17.5% said it happened more frequently more than 10 times. Strong wind and heavy rain throughout the months of December through March (prior to harvesting is taking place) are the main causes and conditions linked to this apprehension, along with harvest failure and sick or unhealthy conditions.

In response to a question, In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? 52.5% of respondents said they had not, while 47.5% said they were unable to eat regular meals. Of those who had, 32.5% had experienced it less than four times, and 12.5% had experienced it more than 10 times. Strong winds and lots of rain during the months of December through February (while waiting for harvest time) cause this circumstance.

In response to a subsequent inquiry, In the last year (2022) did your family / household ever been forced to eat food that was unsuitable to eat? (i.e because they have not been able to obtain other/better kinds of food), 45% said they had not experienced the condition, while 55% said they had. 47.5% of respondents said that this condition occasionally occurred less than four times, and 7.5% said they have experienced it more than ten times. Such circumstances typically occur from December through February, during the rainy season, and are accompanied by severe winds.

Reducing food portions was also recorded. In aldeia Raebutiudu, 77.5% of respondents said they had to reduce the portion of food they provided for their families due to a lack of food. Sixty percent of respondents said they had experienced portion-reduction occasionally less than four times, and 17.5% said they had done so more than ten times. Additionally, limiting the number of meals eaten throughout the day occurs frequently for the HH in aldeia Raebutiudu; last year, 67.5% of the HH did so because they had insufficient food, while only 32.5% said they did not.

However, 70% of respondents claim that there is food to eat in the house, 30% of respondents said that sometimes (less than four times), they don't have food to eat, and 27.5% of respondents confirmed that some members of the family have gone to bed hungry at night. Only 5% of respondents reported not having any food or being unable to eat for an entire day, compared to 95% who said they had not encountered either of these conditions in previous year. It is reported that this circumstance was mostly caused by strong wind and heavy rain.

Aldeia Gourema, Ainaro

General Household Information

The forty HH respondents surveyed in aldeia Gourema, there were 27.5% females and 72.5% males. The respondents' ages range from 26 to 80. The majority of respondents (85%) work as farmers, while 10% are housewives and 5% are suco/aldeia council members. The respondents Stages of progress were categorized as 35 % category B (Escaping poverty), 45% category A (remaining poor), 7.5% category C (falling into poverty), and 12.5% for category D (remaining not poor)

Typical food consumed and food security status in aldeia Raebutidu

From a total of 40 HH interviewed in aldeia Gourema, it was determined that the primary typical food for the HH and the community in aldeia Gourema consists of arrowroot, rice, corn, taro, and potatoes, with a percentage of 97.5%, 95%, 87.5%, and 65% respectively.

Table 5. Typical food consumed by the HH/community in aldeia Gourema

Primary food consumed	Frequency	Percent
Arrowroot	39	97.5
Rice/Foos	38	95.0
Corn/Batar	35	87.5
Taro /Talas	29	72.5
Potatoes/Fehuk	26	65.0

When the following question was posed to the respondents 'In the last year (2022), 'Did your family / household worried that they did not have enough food? Only 10% of respondents in aldeia Gourema said they worried about not having enough food to feed their families, although they only worried occasionally, less than four times during the previous year. 90% of respondents in said they did not worry at all about food inadequacy.

Responding to other related questions to the food security, such as In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? did your family ever been forced to eat food that was unsuitable to eat? did your family ever reduced food portion size because of inadequate means? did your family ever reduced the number of times a day they eat? did your family had no food to eat? did your family went to bed hungry because there was no food? did your family were unable to eat for one whole day? The overwhelming majority of respondents, 95 to 100% answered no to the aforementioned questions, indicating that there were no food shortage difficulties in the Gourema community in 2022.

Aldeia Caihula, Baucau

General Household Information

33.3% of the 39 respondents who were interviewed in aldeia Caihula, suco Uma ana Ulu, were female, and 66% were men. The respondents' ages range from 21 to 90. The majority of respondents (64.1%) work as farmers, followed by housewives (15.4%), students, and civil servants (5.1% each), as well as a tiny percentage of drivers, carpenters, and unemployed. The respondents in aldeia Caihula were divided into four categories based on the Stages of Progress (SoP), 28.2 % category B (Escaping poverty), 71.8% category A (remaining poor), zero for category C (falling into poverty) and D (remaining not poor)

Typical food consumed and food security status in aldeia Caihula

In response to the inquiry "What is a typical meal in your household/community" from a total of 40 HH interviewed, the five common foods for the HH and the community in aldeia Caihula were found to be 100% rice, 79.5% banana, 71.8% corn, 61.6% potatoes, and 46.2% casava

Table 6. Typical food consumed by the HH/community in aldeia Caihula

Primary food consumed	Frequency	Percent
Rice/Foos	39	100
Banana/Hudi	31	79.5
Corn/Batar	28	71.8
Potatoes/Fehuk	24	61.6
Casava/Aifarina	18	46.2

When the following question was posed to the respondents 'In the last year (2022), 'Did your family / household worried that they did not have enough food? In response to this question, little over 60% of respondents in Caihula's aldeia said they had no concerns about food scarcity the previous year. However, 38.5% of respondents said they were worried about not having enough food for their families. When agricultural production is low, demand for and the price of agricultural products fall, and poor weather condition (too much rain and strong winds), the sensation of worry occasionally occurs.

Respondents were posed a question, In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? 77% of respondents reported they had not encountered the circumstance, in contrast to 23% of respondents who claimed they occasionally faced it less than four times. When there is a lot of rain, like in January to February and June to August, this condition develops. In addition, 92% of respondents said they had never been in a position where they were required to eat food that was unsuitable, and only 8% said it had occasionally happened to their family or HH.

Reduced food portions and frequency of eating were also recorded in aldeia Caihula; 26% of respondents acknowledged reducing food portions and frequency of meal times occasionally by fewer than four times due to food scarcity. In contrast, this event was not experienced by 74% of the respondents. 90% of those surveyed in aldeia Caihula reported

not experiencing having no food, and no family going without food for an entire day in 2022 was reported.

Aldeia Saraida, Baucau

General Household Information

30% women and 70% men made up the forty HH respondents who were interviewed in the aldeia Saraida, suco Baguia-Quelicai, Baucau. The respondents are between the ages of 28 and 81. Farmers make up the majority of responders (80%), followed by housewives (10%), and people working as suco council members, government employees, and small company owners (10% of the total). The respondents in Aldeia Saraida were classified as being in Stages of Progress in the following percentages: 37.5% in Category B (escaping poverty), 62.5% in Category A (remaining poor), and zero in Category C (falling into poverty) and D (remaining not poor).

Typical food consumed and food security status in aldeia Saraida

The five common meals consumed by HH and the community in aldeia Saraida were found to be rice (97.5%), corn (90%), taro (72.5%), potatoes (60%) and arrowroot (52.5%)

Table 7. ypical food consumed by the HH/community in aldeia Saraida

Primary food consumed	Frequency	Percent
Rice/Foos	39	97.5
Corn/Batar	36	90.0
Taro /Talas	29	72.5
Potatoes/Fehuk	24	60.0
Arrowroot/Kontas	21	52.5

When questioned about their concerns of having not enough food 'In the last year (2022), 'Did your family / household worried that they did not have enough food? In response to this question, the majority of respondents, 95% of HH in aldeia Saraida-stated that they had no concerns about not having enough food the year before, while just 5% of HH expressed concern about not having enough food to feed the family in 2022.

In response to additional inquiries about food security such as In the last year (2022) did your family / household was unable to eat typical meals because of insufficient means? did your family ever been forced to eat food that was unsuitable to eat? did your family ever reduced food portion size because of inadequate means? did your family ever reduced the number of times a day they eat? did your family had no food to eat? did your family went to

bed hungry because there was no food? did your family were unable to eat for one whole day? The majority of respondents (97.5–100%) in the aldeia Saraida gave a negative response to the aforementioned questions, indicating that there were no difficulties with food security or scarcity in the community there in the previous year, 2022.

11.3.4 Summary of the finding

The following is a summary of the food security situation in the six study locations: Loro, Bemetan, Raebutiudu, Gourema, Caihula, and Saraida based on the data presented in this report:

Loro:

Having few concerns about food insufficiency

A small portion of HH occasionally unable to eat their typical meals

A small portion of HH experienced being forced to eat unsuitable food

Almost no HH had their food portions and frequency of meals reduced.

Almost no HH run out of food, go to bed hungry at night and go without food for a whole day

Rice is the most popular food

Bemetan:

Having high concerns about food insufficiency

A small portion of HH occasionally unable to eat their typical meals

A small portion of HH experienced being forced to eat unsuitable food

A small portion of HH had their food portions and frequency of meals reduced.

Almost no HH run out of food and go without food for a whole day

A small portion of HH go to bed hungry at night

Rice is the most popular food

Raebutiudu:

Having high concerns about food insufficiency

A medium portion of HH occasionally unable to eat their typical meals

High portion of HH experienced being forced to eat unsuitable food

Very high portion of HH had their food portions and frequency of meals reduced

A small portion of HH experienced run out of food

A very small portion of HH go without food for a whole day

A small portion of HH go to bed hungry at night

Corn is the most popular food

Gourema:

Having small concerns about food insufficiency

Almost no HH experienced of unable to eat their typical meals

Almost no HH experienced being forced to eat unsuitable food

Almost no HH had their food portions and frequency of meals reduced

No HH experienced run out of food and go without food for a whole day

No HH go to bed hungry at night

Arrowroot is the most popular food

Caihula:

Having small concerns about food insufficiency

Small portion of HH experienced of unable to eat their typical meals

Small portion of HH experienced being forced to eat unsuitable food

Small portion of HH had their food portions and frequency of meals reduced

Small portion of HH experienced run out of food

No HH go without food for a whole day

Rice is the most popular food

Saraida:

Having very small concerns about food insufficiency

Almost no HH experienced of unable to eat their typical meals

Almost no HH experienced being forced to eat unsuitable food

Almost no HH had their food portions and frequency of meals reduced

No HH experienced run out of food

No HH go without food for a whole day

No HH go to bed hungry at night

Rice is the most popular food

Table 8: A summary of the proportions of SoP categories, the current proportion of households in poverty, farming households, households with agriculture as primary income and households with food concerns at some time of the year.

Location	%A	%B	%C	%D	%Poverty (from SoP)	%Farmers (from SoP)	%Agric as principal income	%Food concerns
Loro	25	65	1	2	26	67.5	57.5	25
Bemetan	5	65	1	2	7	47.5	32.5	67.5
Raebuti-Udo	45	52.5	2.5	0	47.5	60	40	90
Gorema	45	35	7.5	12.5	52.5	85	92.5	10
Caihula	71.8	28.2	0	0	71.8	82.5	70	38.5
Saraida	62.5	37.5	0	0	62.5	77.5	20	5

11.3.5 Conclusions

- The occurrence of food security concerns seems to be independent of current poverty occurrence (by that location's chosen standards). At the extremes, Bemetan has very low poverty rates (by their standards) but many concerns about food security. Gorema and Saraida have high poverty rates but few concerns about food security.
- The occurrence of food security concerns seems to be independent of the proportion of farmers or proportion with agriculture as primary source of income.
- Strong winds and/or heavy rain, and by inference yield losses caused by them, and an inability to do the required farm work due to old age or incapacity, are a common reason for food insecurity.