# BASELINE STUDY ON THE IDENTIFICATION OF LOCAL PRODUCTS IN TIMOR-LESTE THAT HAVE POTENTIAL FOR EXPORT MARKET AND TO ATTRACT PRIVATE INVESTMENTS IN AGRICULTURE SECTOR

**FINAL REPORT**

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**Dili, 2020**

# PREFACE

Investment and Export Promotion Agency, Public Institute as so called TradeInvest Timor-Leste (TITL) is pleased to present this baseline study report as part of its activity to promote and facilitate export growth in Timor-Leste. As mandated by the Decree Law Number 45/2015, 30th of December, TITL is the prime facilitator for private investment and export promotion. The Directorate of Export Promotion (DEP) of TITL has been tasked to promote, facilitate, monitor, advocate and conduct study to identify challenges and opportunities for export and re-export of goods and services in Timor-Leste.

Agriculture is one of the priority sectors as set out in the Timor-Leste National Strategic Development Plan (NSDP) 2011-2030. Despite challenging, in fact agriculture sector in general has visible export potential that can provide more business opportunities for private investments (both national and foreign), which eventually will contribute to economic growth, job creation and poverty alleviation.

There is a potential and large export market for the organic products of Timor-Leste. In fact, the quantity market demand is huge. Currently, Timor-Leste's agriculture product export is dominated by coffee. The USA, Germany, Australia and Japan are the main market destination for coffee export. Timor-Leste also exports small volumes of frozen fish, dried fish and seaweeds to China; organic candlenut oil to Hawaii and China; and vanilla to Australia and New Zealand. In addition, potential products that are well suited for process manufacture (home-industry) in Timor-Leste include: agricultural raw materials, such as rice, coffee, soybean, edible oils and fats (including coconut oil), candlenut oil, soaps, corn flour, animal feed and peanuts. Wood and bamboo based products such as furniture as well as handicraft products are also very potential.

To develop agriculture sector and to attract more national and foreign direct investors to invest in the sector, the Government through TITL needs to undertake pro-active promotion regarding the potentiality of this sector including quantity of production, types of products, agriculture infrastructures and market linkages and facilities. For an effective and successful promotion to attract private investors, the Government Especially Directorate of Export Promotion of TITL needs credible information and data.

Therefore, in July 2017, TITL signed a Technical Cooperation Agreement with the Timor-Leste National University through National Center for Scientific Research to conduct a baseline study to identify and collect information regarding the potentiality of agriculture products to attract private investments in the sector and to grow export from the identified potential products.

TITL expects that the findings of this baseline study will help key players to focus and plan strategic actions to reduce current burden around private investment and export of key growth sectors.

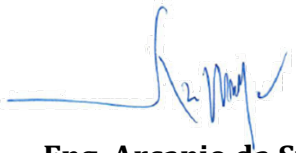
The constraints identified in this baseline study will allow TITL to play its advocacy role by communicating the constraints to relevant Government Ministries for possible necessary reforms.

Finally, this piece of work serves as an internal document that will guide TITL in implementing and executing its annual actions and budget plan for the period of 2020-2023.

TITL will utilize the data and information provided in this report to develop a national digital mapping for export promotion and to better promote investment and export opportunities in Timor-Leste, hence, to attract more private investments with export orientation in productive sectors including agriculture.

TITL would welcome any constructive comments/feedback from users of this publication for improving the future work of TITL.

On behalf of TITL, I would like to express my sincere appreciation to the National Center for Scientific Research of the National University of Timor-Leste and the Directorate of Export Promotion of TITL for the excellent and hard work to complete the baseline study.



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## ACKNOWLEDGEMENT

On behalf of the National Center for Scientific Research UNTL we would like to acknowledge the following parties for their valuable support:

- Rector of UNTL – Doctor Francisco Martins
- Executive Director of TradeInvest Timor Leste – Mr Arcanjo da Silva
- Director of Export Promotion, TradeInvest – Mr Decio Sarmento
- Dean of Agriculture Faculty UNTL – Carlito M. Araujo, PhD
- Director of the Department of Socio Economic – Mr Mateus Gomes, PhD
- MAP Directors of 12 municipalities
- All CNIC staff and Researchers from Agriculture Faculty UNTL and Trade Invest

Our appreciation is dedicated to extension workers for their commitment, support and guidance during the field work, and especially to our final year students who spent most of their time in the field. Finally, our appreciation is also dedicated to stakeholders involving in this study for their guidance and support. This study is possible with the financial and technical supports from TradeInvest Timor-Leste.


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## TERMS AND ABBREVIATIONS

| | |
|---|---|
| ADB | Asian Development Bank |
| AIP | Australia-Indonesia Partnership |
| ACIAR | Australian Center for International Agriculture Research |
| ACELDA | Name of local business |
| ASC | Agriculture Service Center |
| Cap | Capita |
| CCT | Cooperativa Cafe Timor |
| CNIC | Centro Nacional de Investigacao Cientifica |
| CLN | Centro Logistica Nacional |
| CAAKUB | Centro Atendimento Agricola Kuda Ulun Bobonaro |
| DGE | Direcao Geral Estatistica |
| DNAHE | Direcao Nacional de Agricultura, Horticulture e Extencao |
| DNS | Direcao Nacional Estatistica |
| FAO | Food and Argiculture Organization of the United Nation |
| FGD | Focus Group Discussion |
| ha | Hectare |
| GDP | Gross Domestic Product |
| GoTL | Government of Timor Leste |
| IMF | International Monetary Fund |
| Kg | Kilogram |
| Ltd | Limitada |
| MAFF | Ministry of Agriculture, Fisheries and Forestry |
| MAP | Ministerio Agricultura e Pescas |
| MAEOT | Ministerio Administracao Estatal e Ordenamento Territorial |
| MECAE | Ministry of State and Coordinator of Economic Affairs |
| MCIA | Ministerio Comercio, Industria e Meio Ambiente |
| MoF | Ministry of Finance |
| Mt | Metric ton |
| NGO | Non Governamental Organization |
| NSD | National Statistic Directorate |
| NCBA | National Copoperative Business Association |
| NTT | Nusa Tenggara Timur |
| Na | not available |
| PRISMA | Promoting Rural Income Through Support for Markets in Agric. |
| RAEOA | Regiao Administrativa Especial Oecusse Ambeno |
| RDTL | Republica Democratica de Timor-Leste |
| SPSS | Statistical Package for Social Science |
| TLHS | Timor Leste Household Survey |
| UN | United Nation |
| UNFPA | United Nation Population Fund |
| UNTL | Universidade Nacional de Timlor Lorosa'e |
| USA | United States of America |
| USD | United States Currency |
| VCO | Virgin Coconut Oil |
| ZEESM | Special Social Market Economic Zone |
| $ | Dollar |
| % | Percentage |

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## EXECUTIVE SUMMARY

As highlighted in the Timor-Leste National Strategic Development Plan 2011-2030, agriculture plays an important role in reducing poverty, promoting rural development and assuring Timor-Leste's food security – both through food production and as a principal source of income for many of the rural poor. The government of Timor-Leste is committed to develop a non-oil economy through the diversification of domestic trade in particular from agricultural sector. This can be seen through the total investment in this sector of $218.4 million (2008-2016).

The vast majority of agricultural activities in Timor-Leste are small-scale, subsistence agriculture, with minimal inputs, resulting in very low yields. Similarly, there are many impediments to seeing agricultural markets emerge, including lack of financial institutions, poor quality roads, inconsistency of supply and quality, and lack of demand for production.

Agriculture sector has not achieved yet its potentiality. Government supports have provided high assistance to this sector, however agriculture productivity to date remains low which is due to weak agricultural management and practices. In one hand, agriculture sector has the potential to contribute to national GDP. On the other hand, there is a lack of private investment in this sector.

Timor-Leste needs private sector to invest more in agribusiness. Productivity levels in Timor-Leste are low by world standards and there is room for the private sector to play an important role in introducing new technologies, providing access to markets, and investing capital in the intensification of production.

The study was conducted in 12 Municipalities of Timor-Leste with exception to Dili Municipality. Respondents were composed of MAP staff (directors, extension workers and others), lead farmers/head of farmer group, head of villages and sub villages, community leaders, teachers, traders, buyers, national and international NGOs, and coordinator of MCIA. The general objective of the study is to identify and collect information of local agriculture products and livestock in Timor-Leste that have potential for export market and to attract more private investments in agriculture sector.

The result of the study shows the existing local agriculture products and livestock in 12 municipalities of Timor-Leste composed of maize, paddy rice, coffee, coconut, candlenut, sweet potato, cassava, coconuts, candlenuts, mungbean, cattle, goat, vegetables products and others. In general, there is no significant difference of the existing products and livestock in these areas. In addition, livestock that generally raised are buffalos, cattle, pigs, horse, goat, chicken and others. Most of the production of these existing products is for family consumption with the rest for selling to local market.

The study reveals that there are 23 local potential agriculture products and livestock identified in 12 municipalities in Timor-Leste. These local potential agriculture products and livestock are cattle, rice, maize, coffee, candlenut, coconut, mungbean, banana, cassava, pig, goat, peanut, tomato, shallot, sweet potato, tangerine, vanilla, carrot, clove, red bean, sweet potato and cabbage.

The top five most potential local agriculture products and livestock identified in **RAEOA** are *cattle, rice (membramo), cassava, goat and chicken*. RAEOA is well known as one of the potential areas for cattle production in Timor-Leste. The total production of cattle in RAEOA in 2017 is 18 835 heads or equivalent to 1816.9 tons' meat (1 cattle = 100 kg meat carcass). The demand for bovine meat in RAEOA is only 82.01 t/year (4.3% of the total production of bovine meat nationally). In addition, lower bovine meat consumption is clearly constrained by low incomes; with mean per capita income per month of $62 - urban $93 and rural $50 (NSD 2011).

The top five local potential agriculture products and livestock identified in **COVALIMA** are *maize*, *mungbean*, *cattle*, *cassava and pig*. More than 50% of population in Covalima produce **maize** with the total production of 10 335 tons The main market for maize is Ermera, Maubisse and Bobonaro. With the consumption level of 90 kg of maize annually, the demand for maize is around 5400 t/year. This indicated that there is enough production to fulfill the demand needed. Based on the total production, there is still surplus of maize of around 5000 t/year. If this volume is to be sold with the price of 0.60/kg it will generate a total value of 3 million dollars annually.

The top five potential local agriculture products and livestock identified in the municipality of **BAUCAU** are *rice, sweet potato, maize, peanuts and tomato.* The potential cultivated area of **paddy rice** is 14 400 ha, but only 8100 ha are planted (56 %), with the total production of 26 350 tons' paddy rice (=15,810 kg rice) and the productivity of 3.3/ha. In addition, If Baucau can manage to cultivate all the remaining potential areas (6300 ha), it will produce a total of 20 790 tons of paddy rice with the total value of US$8 336 000 in revenue ($400/ton). With the per capita consumption of rice of 95 kg/year, it means Baucau will need around 10 591 tons of rice annually. This indicated the current production of rice can fulfill the demand as the total supply per year is around 15 810 tons' rice; this means there is surplus of around 5000 tons of rice annually.

Top five local potential agriculture products and livestock identified in the municipality of **BOBONARO** are *Paddy Rice, Maize, Mungbean, Cattle and Shallot.* One of the local potential agriculture products in Bobonaro is **Mungbean**. The potential area for mungbean in Bobonaro is 1467 ha but the area planted is only 686 ha (only 47% of the total potential area planted). The production is around 550 t/year with the productivity of 1.10 t/ha. The productivity of mungbean is very low however; it is higher than the national average of 0.90 t/ha. If Bobonaro

can maximize all the potential areas it will produce around 770 tons of mungbean annually; or, if producers can increase the productivity of about 2.5 t/ha it will produce around 3,600 t/year.

Top five local potential agriculture products and livestock in **ERMERA** are *Coffee, Vanila, Tangerine, Shallot and cabbage.* **Coffee** engage an estimated of 44,000 small household producers nationally which represent around 25% of the total population in Timor-Leste; Ermera alone, it engages approximatelly 16,939 household in the sector. The area of coffee in Ermera is around of 28,000 ha (58% of the total area coffee in Timor-Leste). The study reveal the current production (netto) of coffee in Ermera is 9,760,999 kg/year with the productivity of 0.65 t/ha. To increase the yield, there are a number of measure that has being implemented by MAP and CCT which includes the rehabilitation of old coffee trees (pruning), distribution of coffee nursery and others. So far there are around 600 hectares of coffee that has being rehabilitated. According to coffee and cacao expert Mr.Soebadi (CCT consultant), coffee that has being pruned can increase the production by 200% or on average 10 kilograms per coffee tree. If prune can increase production as mentioned, it means the productivity of coffee in Ermera will rise up to 1.95 tons per hectare. This will resulted in the increase of production by 54,600 tons annually.

Top 5 local potential agriculture products and livestock in **LIQUICA** are *Coffee, Banana, tangerine, cattle and maize.* **Banana** is one of the local potential products in Liquica, which employed a significant number of households to produce. The average farm size for banana cultivation is range from 0.2 to 2 hectares. The yield is very low accounted for 0.91 t/ha, which considered lower than the average yield of most of bananas producing countries such as Philippines and Ghana of 13.3 t/ha. For potential areas such as Loes, the income of the majority of the population is generated from banana. This reflects by a large quantity of the products (95%) sold in the market; and the main market is Dili. The average price of one big bunch is $3.00 (one big bunch = 15 small bunches). The weight of a big bunch is 20 kilograms and small bunch is 1.34 kilograms. This means that the price of one-kilogram banana is 0.15 cents.

Top five local potential agriculture products and livestock in the municipality of **LAUTEM** are *Maize, Coconut, Cattle, Candlenut and Cassava*. The potential area for **Coconut** in Lautem is around 10,000 ha - from this, around 2,400 ha was cultivated. The total production in was 336.59 tons with the yield of 0.24 t/ha. Coconut can be value adding into a number of products, which include Virgin Coconut Oil (VCO), Copra and Soap. This study reveals that in one day it can process about 900 coconuts - this produces around 90 litters of VCO (10 coconut = 1 litter VCO). If the production of VCO is sustainable it needs 32,850 coconuts per year, which will produce around 3,285 litters VCO annually. In terms of marketing, so far VCO from Lautem is marketed through domestic market (e.g., Lospalos and Dili market) and exported to Australia.

*Paddy rice, Maize, Cattle, Coconut and Candlenut* is the top 5 local agriculture products and livestock that are potential in the municipality of **VIQUEQUE**. The potential area for **Candlenut** is 3,081 ha; from this around 890 ha are planted (480 ha is productive). There is a lack of data about production in Viqueque but in Timor-Leste the productivity per hectare range from 0.5 to 1.0 t/ha; and this is ten times lower than productivity in West-Timor, Indonesia. If candlenut can be managed in an intensive way, one candlenut tree can yield around 200 kilograms (cracked kernel) per year. The main market for candlenut is Indonesian market. Most producers in Viqueque sell only cracked kernel (nuts) to local traders with current average price of 0.75 cents per kilogram. The selling price to the wholesaler in Dili is ranging from US$1.00 – US$1.50 per kilogram. The study reveals that in one-month they can only deliver candlenut one time to Dili with the quantity of 255 kilograms (8-9 sacks @30 kg/sack). Based on the current price and the quantity distributed per month, it will generate an income of US$318.75/month (US$3825/year) for traders and US$191.25 (US$2,295/year) for producers. According to USAID (2015) there is continuing high demand for candlenut in Indonesia as a food ingredient. This offers an opportunity for local businesses in meeting this demand through the increase in planting of candlenut throughout the country.

Top five local agriculture products and livestock that are potential in **MANATUTO** are *Maize, Banana, Cattle, Paddy rice and Tangerine.* **Tangerine** is one of the commodities that is potential in the municipality of Manatuto. Tangerine is grown well in areas range from lowland to upland. Areas suitable for tangerine in Manatuto are inluding Laclubar, Soibada and some part of Natarbora. The total potential area for tangerine in Manatuto is around 19,800 ha, and from this there is only 8.67 ha was planted in 2012 and 9.10 ha in 2013. The total production was 104.04 and 91.00 tons respectively; while the productivity is 11 t/ha and this is still low compared to Indonesia of 21 tons per hectare.

Top five local potential agriculture products and livestock in the municipality of **AILEU** are *Vegetable, Coffee, Tangerine, Clove and Shallot.* Aileu is known as one of the main supplier of **vegetable** products (mustard and others) to the main market in Dili. As the volume of importation of vegetable products reduced significantly – domestic markets are depending on this area to produce more to fulfill the demand. There are around 79% of household in Aileu growing vegetable. The total production in 2013 was 352,865 kg – and this is deriving from *45 types of vegetables*, which includes mustard, lettuce, broccoli, cauliflower, jukini, and others. The average yield of vegetable in Aileu is 4.95 t/ha. In addition, the potential area or vegetable production in Aileu is 13,000 ha. From this, there was only around 8.64% was planted. The main buyers are local traders and collectors, supermarkets (Kmanek, W4 and Dili Mart) and some agribusiness firms such as Nova Casa Fresca.

Top five local potential agriculture products and livestock in the municipality of **MANUFAHI** are *Cattle, Maize, Paddy rice, Banana and Mungbean*. **Maize** is one of the potential products in Manufahi. It is around 78% of households in Manufahi engage in the production of maize. The total area planted in 2019 was 1523.30 hectares with the total production of 3196.96 t/year and the average yield of 2.48 t/ha. The main market is Dili and surrounding districts. Local traders from Baucau, Manatuto, Ainaro, Ermera and Aileu normally purchase maize from Manufahi and sell it to the consumers. There is lack of market opportunity for this product as the quantity of maize sold is very small. The price offered is 0.35/ kg ($8/sack of 25 kg and $15/sack of 50 kg). If assumed that a half of the current production (2133.78 t) is sold with the current price ($350/ton), it will generate revenue of $746,823 annually ($106.10/household).

Top five local agriculture products and livestock that are potential in **AINARO** *are Coffee, Maize, Red bean, Cabbage, and Carrot.* **Cabbage** is one of the horticulture crops that grown and produce by most of producers in Ainaro particularly in Hatubuilico and Maubisse. These areas are well known as production center for cabbage in Timor-Leste. The total area planted is 182.02 ha with the production of 675 tons and the productivity of 3.71 t/ha. This productivitiy is slightly hihgher than national average of 3.09 t/ha. The productivity of cabbage can be increase by up to 20 tons per hectare as far as it is grown under good conditions and use of good seed varieties. The study reveals that in cabbage season (April-July) traders can deliver in a weekly basis of 1500 cabbages (one truck) to Dili market (Taibessi and Manlewana market).

The majority of producers (88.92%) did not perform **value added** for the product before distributed to the market. The main reason is producers do not know how to value add the products, lack of knowledge and skills, there are no price differences between value added products and primary products and lack of buyer for value added products.

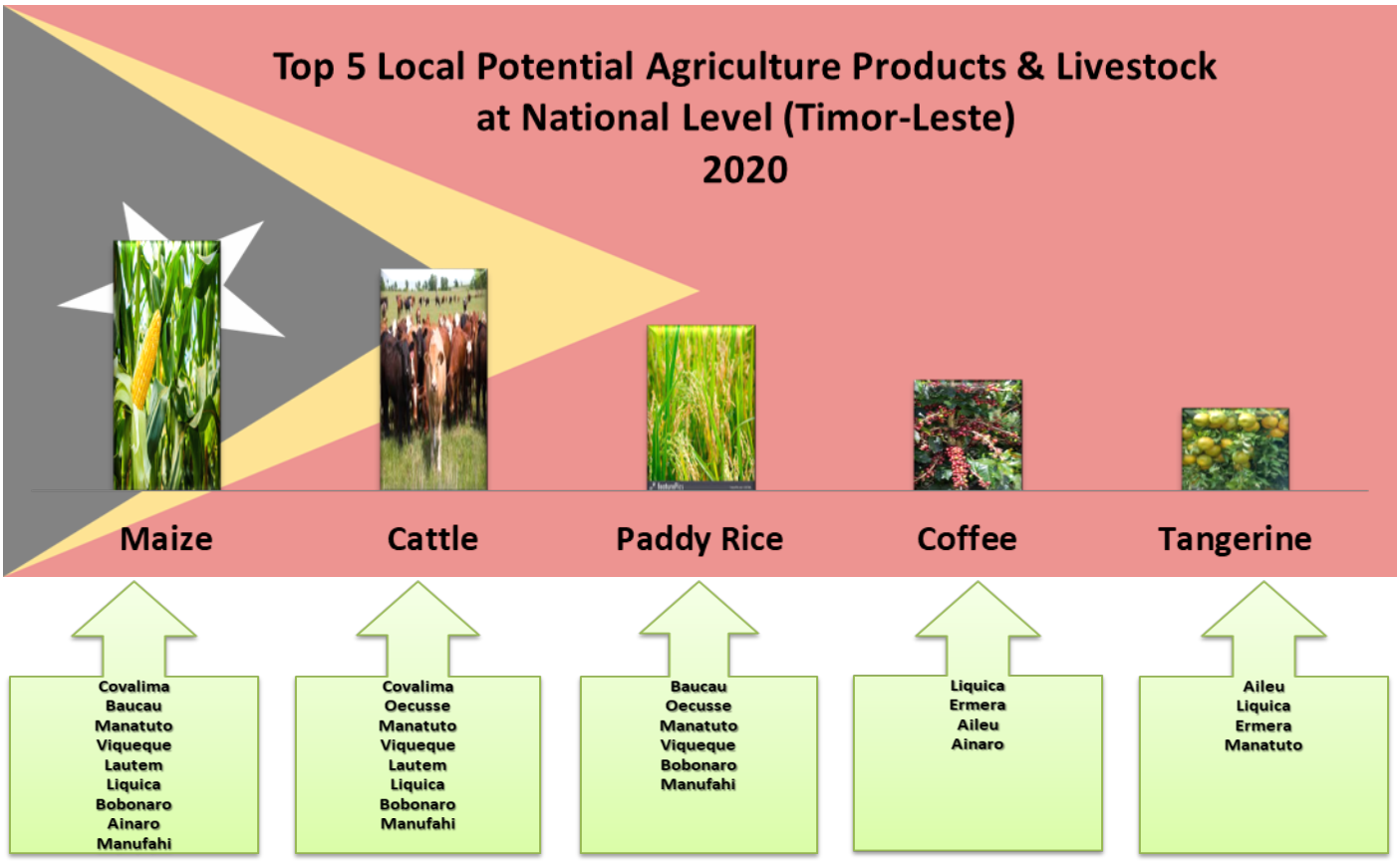
More than 55% of producers usually perform **grading** for the potential products before sell it to market. The type of grading activities conducted is very basic which includes the size of the product, maturity and cleanness. Grading activities mostly conducted for potential products includes banana, maize, coconut, tangerine, candlenut, shallot, vegetable products and cassava.

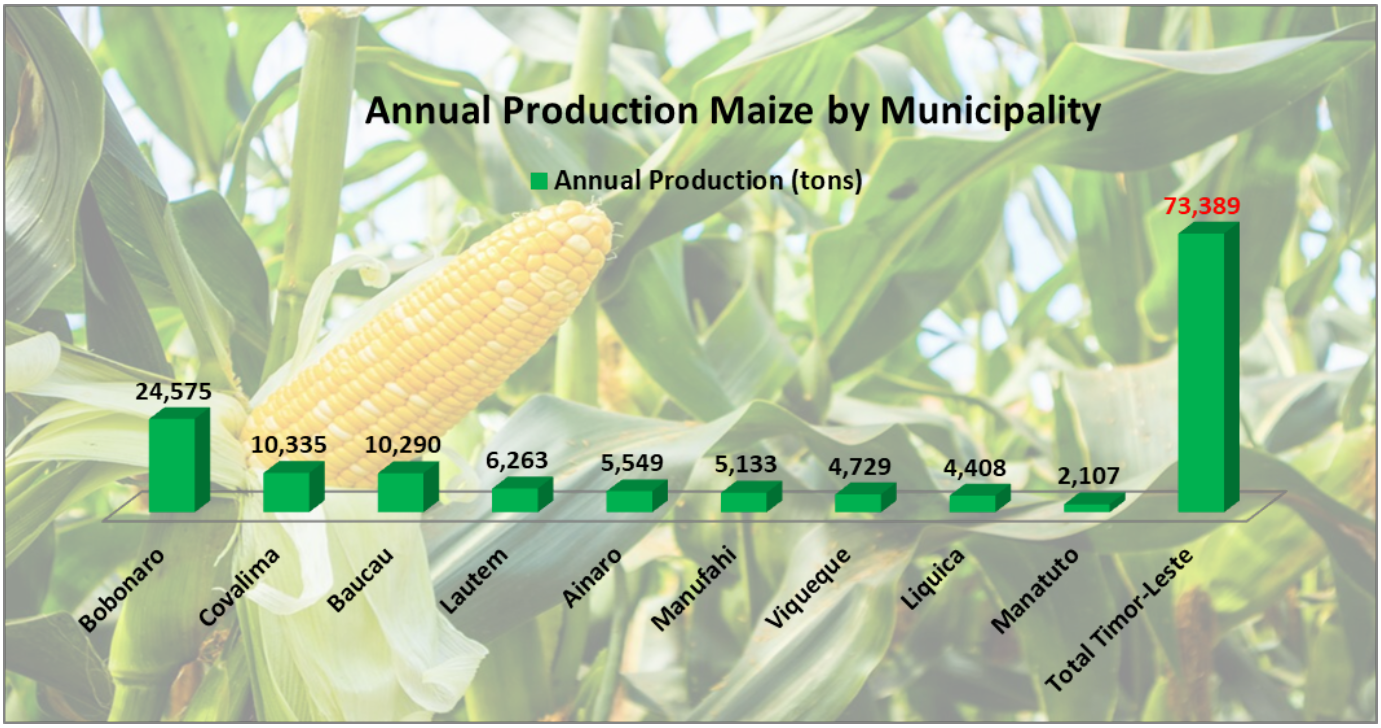
**Constraints** faced in the development of local potential agriculture products and livestock in Timor-Leste are including low production and productivity, lack of access to market, low skill and management, lack of financial support, low output prices, poor quality product, low input use, lack of labor, economic of scale and inconsistency of government policy.

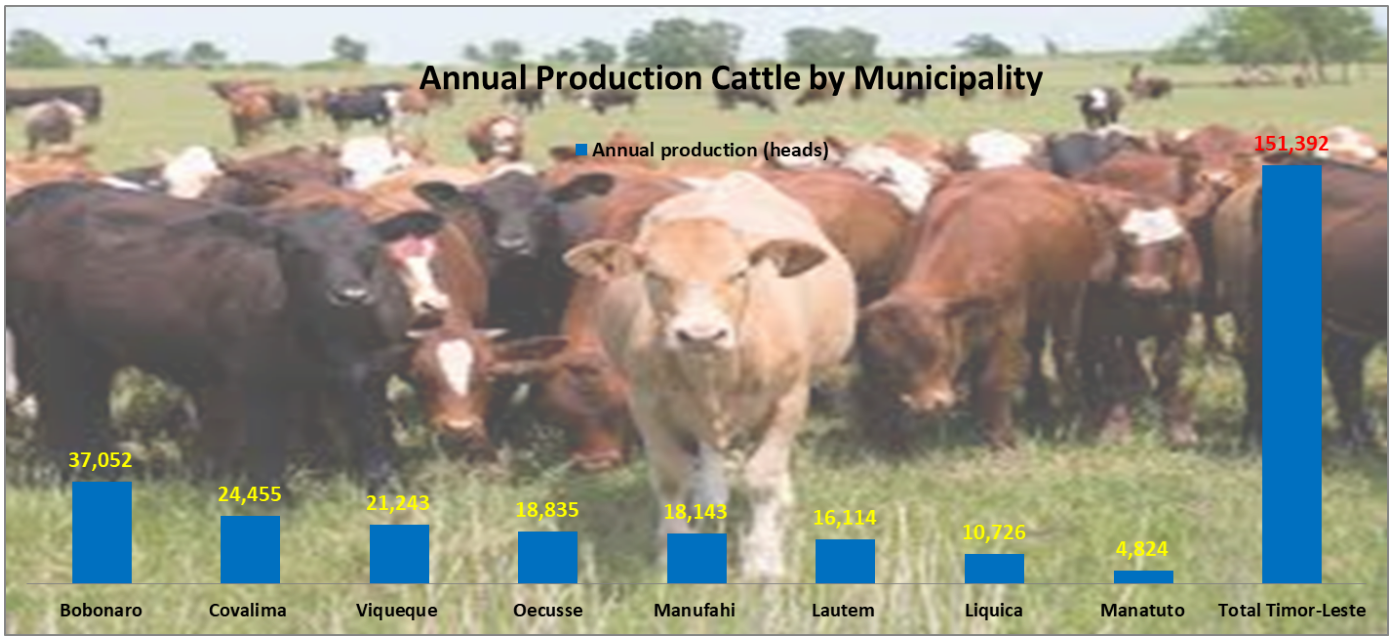
**Opportunity** offered for the development of these potential products are opportunity to increase production; and there is a high demand for bovine meat in the domestic market and export.

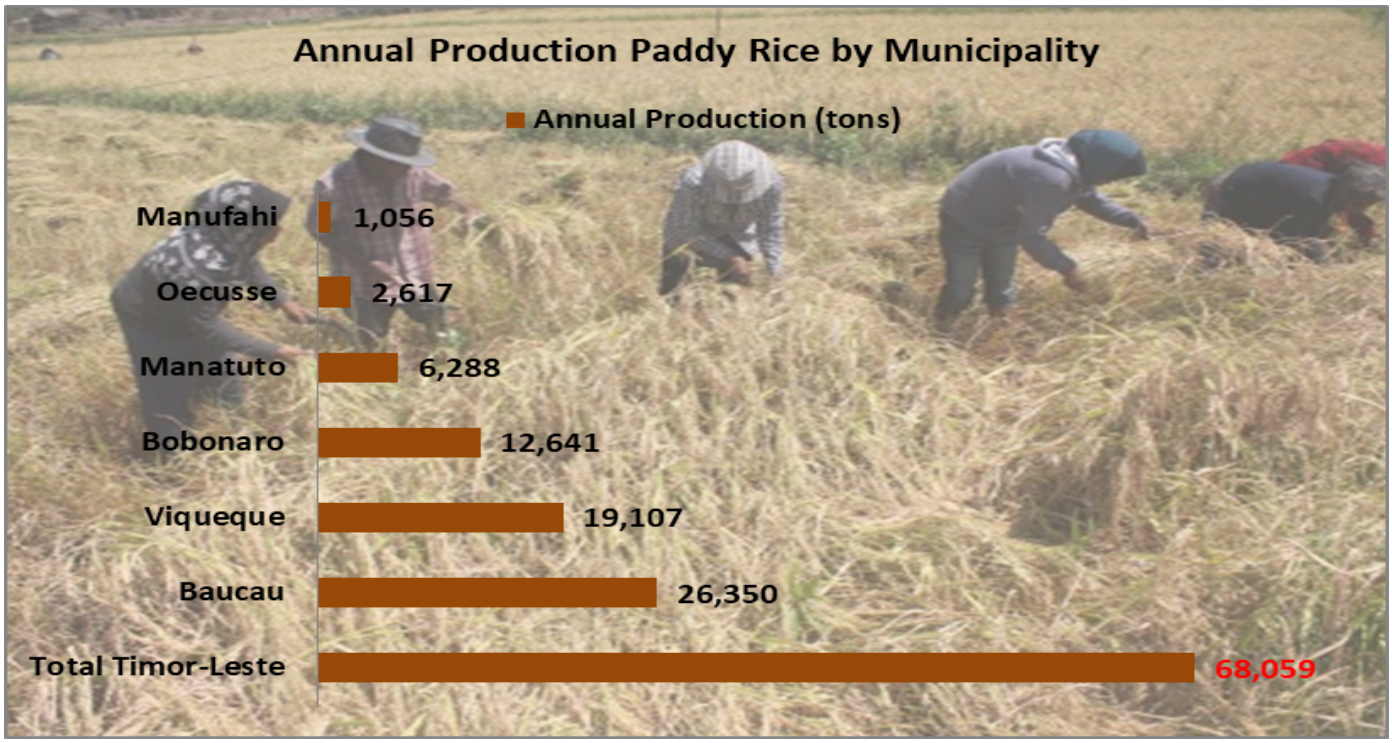
The result of the study clearly demonstrates that there is a potential to develop local potential agriculture products and livestock in Timor-Leste. To better develop these potential products and livestock, it is **recommended** that 1) Supporting farmers to transition subsistence farming to a market oriented agriculture 2) Providing support and assistance to producers and chain players engaging in the distribution of local products to market 3) Providing capacity building to all chain players to ensure the efficiency and effectiveness of the supply chain 4) Motivating producers with necessary incentives 5) Providing support to agribusiness firms in terms of technical and financial support 6) Re-opening of export market (cattle) with Indonesia 7) Improving business environment 8) Investing in more value-adding and marketing activities for local potential agriculture products; and 9) Introducing high yield varieties for local potential agriculture products and livestock.

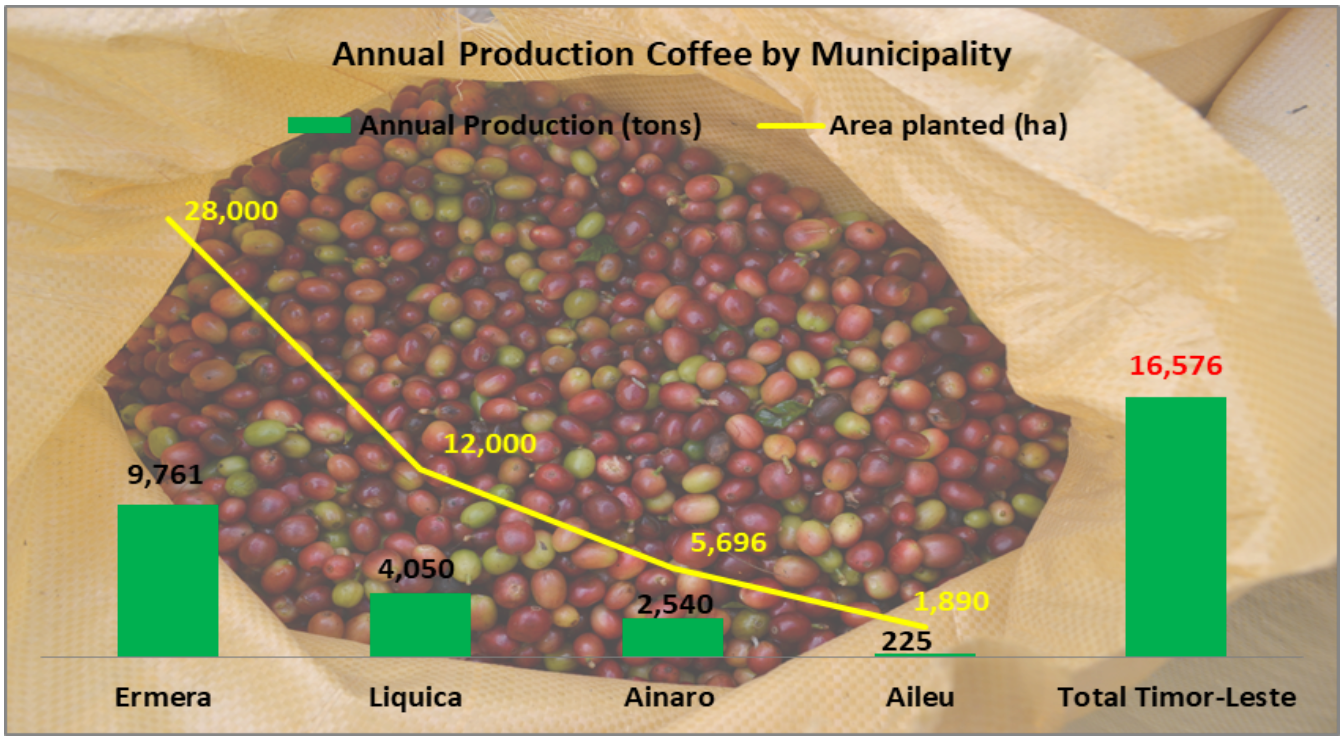
## HIGHLIGHTS OF KEY FINDINGS

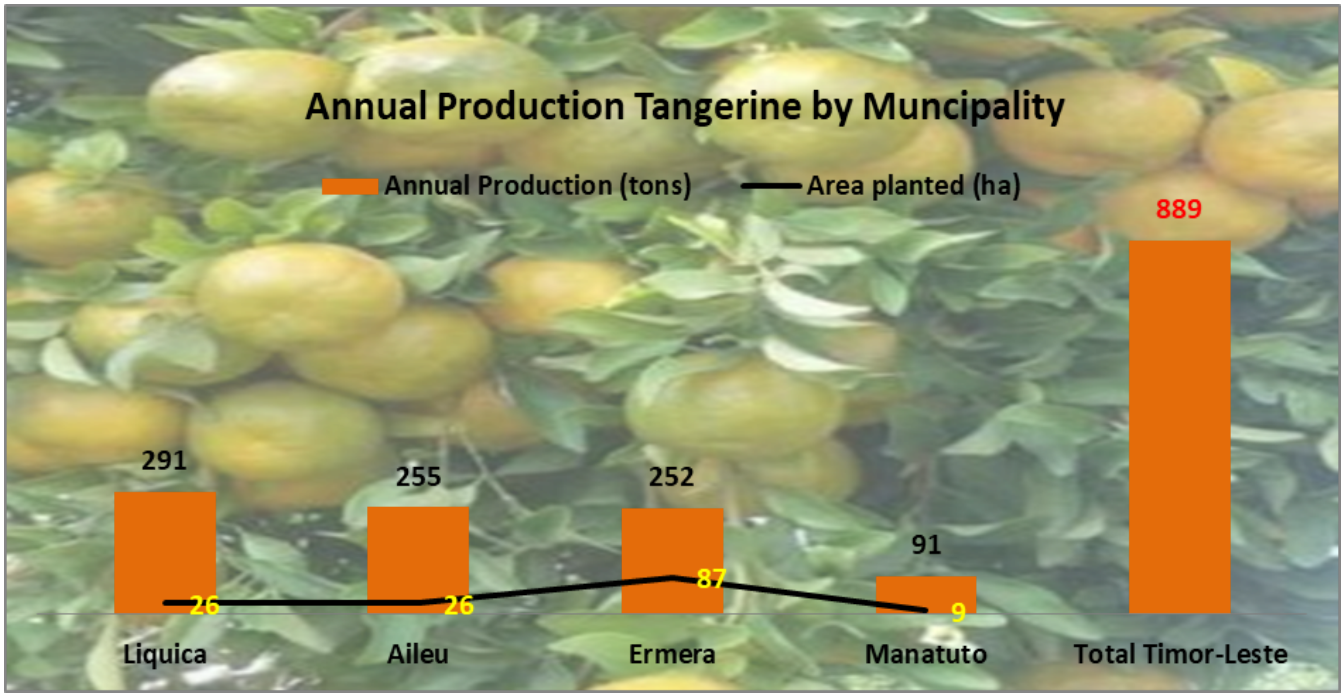



Annual Production Cattle by Municipality
Annual production (heads)
37,052
24,455
21,243
18,835
18,143
16,114
10,726
4,824
151,392
Bobonaro
Covalima
Viqueque
Oecusse
Manufahi
Lautem
Liquica
Manatuto
Total Timor-Leste


Annual Production Paddy Rice by Municipality
Annual Production (tons)
Manufahi
1,056
Oecusse
2,617
Manatuto
6,288
Bobonaro
12,641
Viqueque
19,107
Baucau
26,350
Total Timor-Leste
68,059


Annual Production Coffee by Municipality
Annual Production (tons)
Area planted (ha)
28,000
12,000
5,696
1,890
9,761
4,050
2,540
225
16,576
Ermera
Liquica
Ainaro
Aileu
Total Timor-Leste


Annual Production Tangerine by Muncipality
Annual Production (tons)
Area planted (ha)
291
255
252
91
889
26
26
87
9
Liquica
Aileu
Ermera
Manatuto
Total Timor-Leste

## I. INTRODUCTION

Private investment has the potential to make a positive impact to the country, particularly investing in small-scale producers in agricultural sector is very important. This is due to the 500 million small farmers in developing countries that support almost two billion people, which is nearly one third of the global population (Sahan & Mikhail 2012). Therefore, there is an opportunity for public and private investment to make a substantial positive impact on the livelihoods of small-scale food producers.

Geographically, Timor-Leste is a small country, but has abundant of natural resources. The economy mainly relies on agriculture sector as it may contribute to national GDP, employ almost three quarters of the workforce, provide over 70 per cent of the population with their main sources of livelihood and offer the largest potential exports and trade. In addition, Timor-Leste needs private sector agribusiness investment. Productivity levels in Timor-Leste are low by world standards and there is room for the private sector to play an important role in introducing new technologies, providing access to markets, and investing capital in the intensification of production.

Due to its significant contribution to the development, agriculture sector becomes one of the priority sectors in the Strategic Development Plan 2011-2030. As a priority sector, agriculture in Timor-Leste can provide more opportunities for investors particularly in rural areas where most of the population is concentrating and depending on this sector. In addition, agriculture sector has the potential to be developed, however, at present time; this sector is still far from its potential contribution to the national GDP.

To develop agricultural sector in Timor-Leste and to attract local and foreign direct investor, the government of Timor-Leste through its investment and export promotion agency, as so called TradeInvest needs to do more promotion regarding to the potentiality of this sector including quantity of productions, types of products, agricultural infrastructure, market linkages and others. For a promotion to be successful, information or data as mentioned are very crucial.

Currently, there is a lack of information on the issues mentioned above. Therefore, TradeInvest Timor-Leste in cooperation with National Center for Scientific Research (CNIC) – UNTL conducted a Baseline Study in order to identify and collect information regarding the potentiality of agricultural products in Timor-Leste (e.g., quantity of production, types of products, market linkages and others).

## II. OBJECTIVE

The general objective of this study is to identify and collect information of local agriculture products and livestock in Timor-Leste that have potential for export and to attract more foreign investments in agriculture sector. The specific objectives are:

- To identify types of local agriculture products and livestock existed in Timor-Leste;
- To identify local potential agriculture products and livestock in Timor-Leste;
- To identify the quantity of local potential agricultural product and livestock produced in Timor-Leste;
- To identify demand and supply trend and price index;
- To identify major opportunities and constraints at different places in the market chain for agricultural, livestock and forestry products; and
- To map out the agricultural potentiality of each area in Timor-Leste.

## III. RESEARCH PROBLEM

Agriculture sector has not achieved yet its potentiality. Although, government supports have provided high assistance to this sector, agriculture productivity to date remains low, which can be due to weak agricultural management and practices. In one hand, agriculture sector has the potential to contribute to national GDP. On the other hand, there is a lack of private investment in this sector.

In order to diversify Timor-Leste's economy, the VI Constitutional Government through the Ministry of State and Coordinator of Economic Affairs (MECAE) has put a significant effort to improve the investment climate by re-establishing TradeInvest Timor-Leste as a Public Institute responsible for investment and export promotion. TradeInvest Timor-Leste has been created under the government Decree Law number 45/2015 of 30th December, with some main functions to promote Timor-Leste's investment and export potential, to attract foreign direct investors, to stimulate more national investment and to facilitate both national and international investors during pre-investment and post-investment.

For the purpose of accelerating investment in Timor-Leste, particularly in Agricultural sector, there is a need to collect a credible base line data. With a credible data, it will help develop this sector as well as attracting more local and foreign investors to invest in the country. Therefore, the research problem is "how to obtain credible and comprehensive data" from producers and relevant institutions in Timor-Leste. A good quality data can contribute to a successful promotion of this sector. This can help TradeInvest to promote local agriculture products that are potential for export to niche local market and international market".

## IV. RESEARCH APPROACH

This research was implemented in 12 municipalities in Timor-Leste except Dili. The reason for not included Dili in this study is because it is not really potential for local agriculture products and livestock. Indeed, Dili is the capital city where most people concentrating looking for jobs, study and doing business. The population in this study constituted of farmers, community leaders, MAF staff, extension workers, NGOs and International Agencies and other relevant institutions. These populations were treated as sample for the study. Methods used for selecting the sample were 'Stratified Random Sampling'.

Data was collected from both primary and secondary data (both quantitative and qualitative data). Methods used for gathering data included direct interview/face-to-face, FGD, in-depth interview and review of literature related crop production and marketing and others.

In addition, Participatory Rural Appraisal was used in this study such as physical field survey of the study areas. This study also used a semi-structure interview with community leaders, government institutions and local and international NGOs in order to understand institutional framework, available basic resources and organizations in the study areas. Other direct observation and documentations were also applied into this study.

Data was analyzed by using qualitative and quantitative analysis. In addition, supply chain analysis was carried out to develop a description of the value chain to identify potential high value market areas and current and potential products in the domestic and export markets in relation to the volume, specification, value and growth trends. Thus, computer-assisted qualitative and quantitative data analysis software was used in this study.

## V. CONCEPTUAL FRAMEWORK OF THE STUDY

The agricultural sector has long been recognized as an important sector and plays a significant role in the development process within many developing economies (Pingali 2006). Joshi et al. (2007) found that there has been a trend towards more commercialized farming, greater private-sector participation and a re-defined role of the government. The successful experience from the Asia-Pacific region indicated that the agricultural sector could be used to mobilize and foster economic growth in the first stages of economic development and be transformed from subsistence to a market-based system (Joshi et al. 2007). To accelerate economic growth, there is a need to modernize agricultural production, requiring markets for both inputs supply and for the sale of products and services.

In the case of Timor-Leste, agriculture is the main activity and the majority of its population depends on this sector. Thus, there are varies of crops growing by small-scale producers and the economics of scale of the farm is very small. Apart from the

variety of crops growing by the household, there are a number of crops that is very potential in terms of production and market opportunities both for domestic and export market. In addition, these potential crops can attract foreign investment into the country and also local private investment. Therefore, the identification of the potential products is needed to provide comprehensive information related to the production, market opportunities, prices, demand and supply and other. If those potential crops identified can attract foreign investment and provide opportunities to local private investment in agriculture sector it will result in an increase of agricultural production. This will further impact to the rising in household income and in the end it will contribute to the reduction of unemployment and poverty in Timor-Leste.

The criteria used to identify potential of local agriculture products and livestock in Timor-Leste are including the products contribution to the municipality overall production; current level of production; existing and potential market and export potential of the product; and the total household involvement to produce the product.

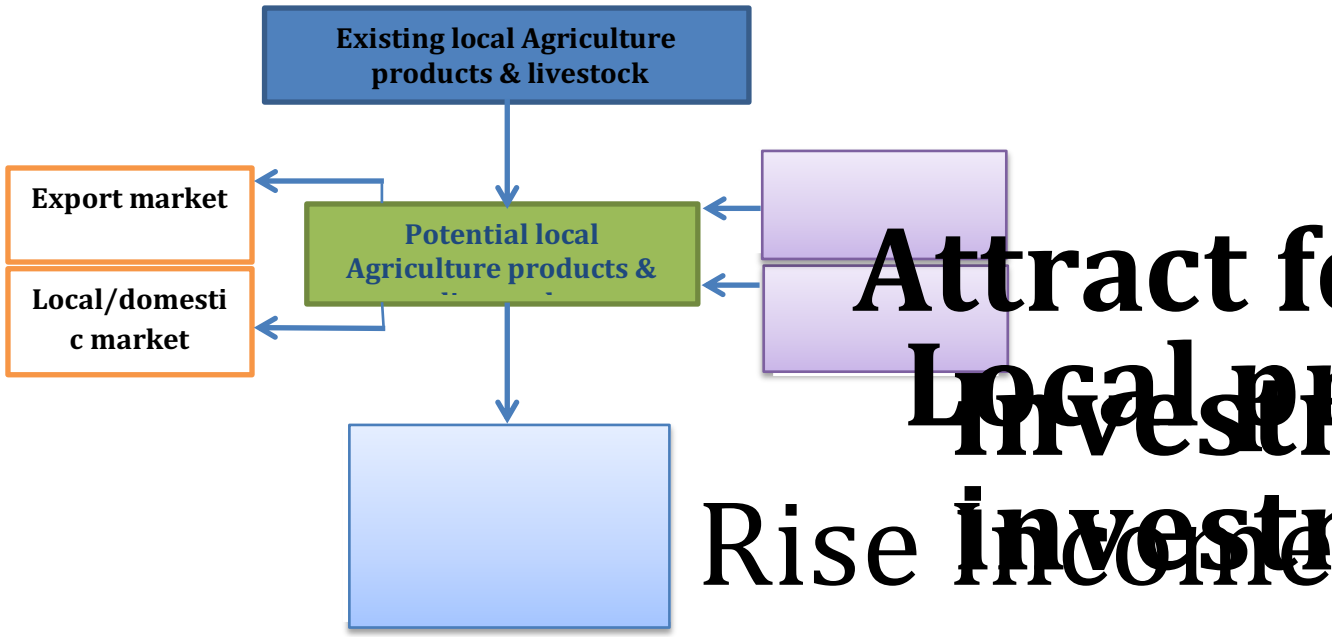



**Figure 1. Conceptual framework of identification and development of local potential products**

## VI. LITERATURE REVIEW

Large investment in agriculture sector is significantly needed to help increase the production and marketing of agricultural products. This will further contribute to the increase in income for rural population and poverty reduction.

Private investment of all forms has the potential to make a positive impact. Therefore, private sector plays an important role in delivering inclusive economic growth, environmental sustainability and poverty reduction. To achieve this, it must be

adequately regulated and should adhere to some key principles, such as focusing on local food markets, working with producer organizations and respecting the rights of small-scale producers, workers and communities.

The main objective of government of Timor-Leste for agricultural sector is to enhance agricultural production, productivity and rural livelihoods. Therefore, investment in agriculture is a fundamental instrument to provide food and nutrition security, reduce poverty, create employment, generate sustainable broad-based economic growth, ensure environmental sustainability (MAP 2012). From 2008 – 2016 government of Timor-Leste has already investing in agriculture sector, which includes irrigation, tractors, free land preparation, seeds, agricultural equipment's and others with the total of $218.4 million dollar (RDTL 2011; National Commission for Research and Development; MAFF 2008; RDTL 2007). However, such investment has not yet produced the desired results, and Timor-Leste remains strongly depended on food imports, its agricultural production remains below potential and household food and nutrition security are still unsatisfactory. Sahan and Mikhail (2012) pointed out government investment into small-scale producers is also a key to both attracting more private investment in small-scale agriculture as well as improving the impact of any such investment.

According to MAP (2012) approximately 75 per cent of Timor-Leste's population lives in rural areas, and most of their livelihoods derive from agriculture. About one third of the country's non-oil GDP is generated from the agriculture sector. In addition, industrial tree crops (mainly coffee) contribute about 23 per cent of export earnings and account for about 80 per cent of non-oil exports. Given its size and influence, Timor-Leste's agricultural sector can generate employment and increase incomes through sectoral development.

Timor-Leste's major farm commodities are food crops (maize, rice, peanut, cassava, and sweet potato), tree crops (candlenut, coconut, coffee, cinnamon, and cloves) and livestock. Coffee is the country's primary non-oil export and approximately 28 per cent of households earn some form of income from coffee (IMF 2011). In 2005 alone, coffee exports equaled $7.6 million, with 49.2 per cent going to the United States followed by Germany (20.7%) and 12 per cent to Portugal. In addition, coastal fisheries appear to have significant economic potential, but they are also vulnerable to overexploitation. Offshore resources include tuna, deep-sea snappers, and deep-sea shrimp, but the sustainable quantities of these resources remain very uncertain (ADB 2011).

As the majority of the population engaged in agriculture sector, raising farm output and income become a key development priority for the country and this can be done through improving agricultural productivity. Other key priorities include development of more effective agricultural markets, policies promoting investment in value-added and export commodities, and better information on prices and export opportunities.

A study done by Sendall (2006) estimates that Timor-Leste currently does not produce enough of the main commodities to feed itself, let alone produce a surplus for export. Therefore, there is an urgent need to increase agricultural production and productivity in Timor-Leste, to satisfy local demand, and produce a surplus for export. Increased economic activity within the sector, particularly trade, will provide employment and additional income across every municipality in Timor-Leste. Rahim (2005) added Timor-Leste has certain attributes that on paper lend it to being suitable to grow produce that could be sold in export markets. One example of this is snow peas. However, although it is possible to work up, certain quantities of produce can be grown, certain volumes can be shipped and external markets are of a certain size. Thus, there appears to be considerable potential to diversify crop production for both local consumption and export (World Bank 2010).

Sahan and Mikhail (2012) concluded that a positive agricultural investment can benefit investors, small-scale farmers, communities and government. Therefore, government should give priority to investments in key public goods including capacity building, infrastructure, and research systems to help small-scale farmers who are not yet market-ready to ensure their food security and livelihood. Private sector on the other hand should complement public sector investment.

## VII. RESULT AND DISCUSSION

### 7.1 Characteristic respondent

The total respondents for this study is 782 respondents, which constituted of MAP staff (directors, extension workers and others), lead farmers/head of farmer group, head of villages and sub villages, community leaders, private sectors, teachers, traders, buyers, national and international NGOs, and coordinator of MCIA in 12 municipalities. The detail of the distribution of respondents per municipality is shown in Table 1.

Table 1. Sample distribution

| No | Municipality | Total sample |
|---|---|---|
| 1 | RAEOA | 44 |
| 2 | Covalima | 47 |
| 3 | Baucau | 50 |
| 4 | Bobonaro | 66 |
| 5 | Ermera | 51 |
| 6 | Liquica | 50 |
| 7 | Lautem | 90 |
| 8 | Viqueque | 85 |
| 9 | Manatuto | 45 |
| 10 | Aileu | 92 |
| 11 | Manufahi | 87 |
| 12 | Ainaro | 73 |
| | Total | 780 |

For the gender balance, male accounted for 87.65 per cent and female is 12.35 per cent. In terms of the education of the respondents, it constituted of 42.97 per cent finish secondary school, 38.45 per cent primary school, 10.10 per cent graduated from university and 8.4 per cent illiterate. The details of the characteristic of respondents are shown in Table below.

Table 2. Characteristic of respondent

| **Description** | | |
|---|---|---|
| Total respondent (people) | | 780 |
| Gender (%): | Male | 87.65 |
| | Female | 12.35 |
| Year (average) | | 44.7 |
| Education (%): | Primary school | 38.45 |
| | Secondary school | 42.97 |
| | University | 10.10 |
| | Not school at all (illiterate) | 8.4 |
| Occupation (%): | Farmer | 35.15 |
| | Community leader | 27.12 |
| | Public servant | 19.86 |
| | Private sector | 6.15 |
| | Othes(e.g., Trader,NGOs,etc) | 11.68 |

## 7.2 Type of local agriculture products and livestock exist in Timor-Leste

The types of local products and livestock exist in 12 municipalities constituted of food crops (e.g., paddy rice, maize, cassava, etc.), horticulture crops (e.g., mustard, tomato, carrot, cabbage, etc.), fruits (e.g., banana, papaya, mango, rambutan, tangerine, etc.), plantation & forest products (e.g., teak, candlenut, coconut, sandalwood, etc.). In addition, livestock raised by most of the population in these municipalities are including cattle, buffalo, goat, pig, horse and others.

Despite the existing products mentioned, the study is also identified a number of new products introduced, which have high value in the market. These products are Maek (Konja), dragon fruit, broccoli, cauliflower, strawberry, lettuce, and cafendix (new variety of banana).

## 7.3 Local potential agriculture products and livestock in Timor-Leste

The result of the study reveals that there are 23 local potential agriculture products and livestock identified in 12 municipalities in Timor-Leste. These products considered potential because it's involve a significant number of population to produce; there is an existing market for these products both local and foreign market; it's contribution to overall income and economy of the people in these municipalities and the total production.

These local potential agriculture products and livestock are cattle, rice, maize, coffee, candlenut, coconut, mungbean, banana, cassava, pig, goat, peanut, tomato, shallot, sweet potato, tangerine, vanilla, carrot, clove, red bean, sweet potato and cabbage. The details of these local potential products per municipality are shown in table below.

Table 3. Local potential agriculture products and livestock in Timor-Leste

| Municipality | Top 5 local potential products and livestock | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| RAEOA | Cattle | Rice | Cassava | Goat | Chicken |
| Covalima | Maize | Mungbean | Cattle | Cassava | Pig |
| Baucau | Rice | Sweet potato | Maize | Peanuts | Tomato |
| Bobonaro | Rice | Maize | Mungbean | Cattle | Shallot |
| Ermera | Coffee | Vanilla | Tangerine | Shallot | Cabbage |
| Liquica | Coffee | Banana | Tangerine | Cattle | Maize |
| Lautem | Maize | Coconut | Cattle | Candlenut | Cassava |
| Viqueque | Rice | Maize | Cattle | Coconut | Candlenut |
| Manatuto | Maize | Banana | Cattle | Rice | Tangerine |
| Aileu | Vegetable | Coffee | Tangerine | Clove | Shallot |
| Manufahi | Cattle | Maize | Rice | Banana | Mungbean |
| Ainaro | Coffee | Maize | Red bean | Cabbage | Carrot |

### 7.3.1 Potentiality of Local potential agriculture products and livestock in RAEOA

Regiao Administrativa Especial Oecusse Ambeno (RAEOA) is situated in the west part of Timor-Leste, about 162 km from the capital city and it can be reached by car, ship and airplane from Dili. The total area is 814 $km^2$ with a total population of 68 913 people (NSD 2015). RAEOA has been designated as a Special Social Market Economic Zone (ZEESM) by the Timor-Leste Government and large-scale infrastructure development and building construction is underway.

Agriculture is the backbone of RAEOA as the majority (78%) of the population is depending on this sector as main source of income. The total area suitable for agriculture is around 18 200 hectares. The major crops grown are maize, paddy rice, cassava and sweet potato; and livestock raised are mostly cattle, buffalo, goats, pigs and poultry. In addition, most of the agricultural production in RAEOA is subsistence agriculture and this contributed to the low productivity of the major crops grown by producers.

The result of the study shows the top five (5) most potential local agriculture products and livestock identified in RAEOA are ***cattle, rice (membramo), cassava, goat and chicken***. From the interview, deep discussion and FGD it appears that these five products mostly described as potential products due to their existing and potential market and export, household involvement and the contribution of these products for overall production in Oecusse.

**Cattle** - RAEOA is well known as one of the potential areas for cattle production in Timor-Leste. The total production of cattle in RAEOA in 2017 is 18 835 heads or

equivalent to 1816.9 tons meat (1 cattle = 100 kg meat carcass). The national consumption level for bovine meat is 1.19 kg/capita/year (Calisto 2014), which is significantly lower than the average for least developed countries of 4.8 kilogram, and also lower than Indonesia of 2.5 kilogram. This affects the demand for bovine meat of only 82.01 ton per year for RAEOA (4.3% of the total production of bovine meat nationally). In addition, lower bovine meat consumption is clearly constrained by low incomes; with mean per capita income per month of $62 - urban $93 and rural $50 (NSD 2011). The details of the description of the potential products in RAEOA are shown in table 4.

Table 4. Description of local potential agriculture products and livestock in RAEOA

| Description | Potential local agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | Cattle | Rice | Cassava | Goat | Chicken |
| Household number | 6 178 | 10 835 | 9807 | 4950 | 10 241 |
| Total production | 18 169 head | 2617.2 t (1570.3 t) | 11 596 t | 14 675 | 46 158 |
| Productivity | Na | 1.25 t/ha | 4.1 t/ha | Na | Na |
| Main market | Indonesia & Dili | RAEOA | RAEOA | Dili & RAEOA | Dili & RAEOA |
| Consumption level (kg/cap/year) | 1.19 | 95 | Na | 0.47 | 8.32 |
| Export (national) | 6 000 head | - | - | - | - |
| Demand (ton/year)<br>▪ Oecusse<br>▪ National | <br>82.01<br>1269.23 | <br>6546.74<br>101 325.3 | | <br>32.39<br>501.30 | <br>573.36<br>8873.96 |
| Supply (ton/year) | 1816.90 | 1570.3 | Na | 513.63 | Na |
| Average prices ($) | 625/head (6.50/kg) | 0.50/kg (0.95/kg rice) | 0.35/kg | 47.50/ head | 15/chicken |

*Source: TLHS 2004; MAF; NSD and UNFPA; RDTL; IMF 2011; Calisto 2014; DNAHE-MAF 2015; MAP RAEOA 2017 # Conversion paddy rice to rice is 60%;*

In addition, based on the total population in RAEOA in 2010, the demand for bovine meat in the next 5 years' time (2017-2022) will increase by 98.4 tons or equivalent to a total of 984 head (increase of 1.6 ton/year). More details on the demand forecast of bovine meat in RAEOA are shown in table below.

Table 5. Demand forecast for bovine meat in RAEOA from 2017 – 2022

| Description | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Population – 2010 | 76 068 | 77 386 | 78 704 | 80 022 | 81 340 | 82 658 |
| Demand for bovine meat (t)- 1.19 kg/cap/year | 90.5 | 92.1 | 93.7 | 95.2 | 96.8 | 98.4 |

*Source: Population projection derived from NSD 2010; Waldron et al. 2015; demand for bovine meat is calculated*

In the supply side however, RAEOA produce around 1800 ton of bovine meat per year. With the national consumption level of 1.19 kg, means there is plenty of bovine meat stock available which can further supply to Dili and other municipalities or export.

Thus, with the annual population growth rate nationally of 2.41% and rising of the income of the population in particular in Dili, it will have resulted in an increase in the demand for bovine meat consumption in the year to come. In terms of export, Timor-Leste experienced exporting of live cattle and buffalos to Indonesia. Export number was officially reported by MAF when the trade was formal before 2010; and the last number of cattle export in 2009 was 900 heads (MAF 2009). Meanwhile, hide trade remains legal, and data is not available.

**Rice (membramo)** - It is another potential local agriculture product in RAEOA. Approximately 85 per cent of rice production in RAEOA is for home consumption. Table 3 indicated the total number of household engage in paddy rice production is around 10 800 and the total production is 2617.2 tons of paddy rice per year or equivalent to 1570.3 tons of rice (MAP RAEOA 2017). However the productivity of paddy rice is very low of 1.25 ton per hectare (lowest than national average of 2.6 ton per hectare).

The market for rice is only in RAEOA with a very small volume is traded to Dili. An interview with rice trader in RAEOA market shows this kind of rice has certain specification including soft and good aroma and therefore there is a number of customers both from Dili that regularly bought rice in a regular basis. In addition, with the level of annual consumption of 95 kg/capita/year (TLHS 2004) means the demand of rice in RAEOA is around 6500 tons per year. In terms of supply, currently RAEOA can only supply around 1570.3 ton per year (41.9%) of rice for its population. This means there is a deficit of local rice (membramo) of around 5976.44 ton per year.

**Cassava** - The third potential local agriculture product is cassava. In RAEOA, cassava is mainly a staple food crop that is grown by farmer's household for family consumption. It is one of the potential products in RAEOA in terms total production (11 596 t/year). It is an important product for household food security. Aside from being used as food for human consumption, it is also widely used for animal feed. The main market for cassava is RAEOA market; and the average price 0.35 cents per kilogram.

**Goat** and **Chicken** is another local potential livestock product in RAEOA that currently entering Dili market in a regular basis. The total population of goat and chicken is 14 675 and 46 158 respectively; and the number of household raising these livestock is 4950 for goat and 10 241 for chicken. The average owned goat and chicken per household is 3.0 and 4.5. The main market for these products is Dili with small number of goats and chickens sold in local market in RAEOA. The average price for goat is around $48 and chicken is $15. With the total population of 68 913 (NSD 2011) and the national consumption level of 0.47 kg/capita/year the demand for goat in RAEOA will be 30.80 ton per year. For chicken, with the consumption level of 8.32 kg/capita/year RAEOA will need around 8800 kilogram of chicken meat to feed its

population. From the supply side, the current production of goat and chicken (see Table 3) can guarantee the availability of these products for the entire year in RAEOA and Dili market.

### 7.3.2 Potentiality of Local potential agriculture products and livestock in Covalima

The municipality of Covalima situated in the Southwest part of the country. It has a population of 64 550 (NSD 2015) with the total area of 1230 km$^2$. The capital of the municipality is Suai, which lies 136 km from Dili, the national capital. Covalima has a significant second crop of maize. Maize is mainly cultivated close to the Indonesian border; meanwhile rice is cultivated in the lowlands under irrigation. Soybean, mung bean and groundnuts are also widely grown. Livestock is mainly composed of buffaloes, cattle, pig and goats.

Covalima is one of the municipalities included in the Mega Project Tasi Mane and therefore there is an intensity of development, which includes airport, roads, and others. This will offer farmers an opportunity to produce more local agriculture products in terms of quantity, quality and continuity of supply.

The top five local potential agriculture products and livestock identified in Covalima are ***maize, mungbean, cattle, cassava and pig***. These are products that mostly described by respondents as potential products in Covalima. The reasons for classifying these products as potential is the fact that most population in this area growing and produce these products, good opportunity for domestic and export markets and farmer experiences in dealing with the production of these products. The details of the production, household involvement and markets for these potential products are shown in Table 6.

Table 6. Description of local potential agriculture products and livestock in Covalima

| Description | Potential local agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | Maize | Mungbean | Cattle | Cassava | Pig |
| Household number | 6398 | Na | 6969 | 6248 | 10 343 |
| Total production | 10 335 t | 413.6 t | 34 455 | 11 596 t | 44 822 |
| Productivity | 2.3 t/ha | 3.5 t/ha | | 8.2 t/ha | 4.3/hh |
| Main market | Ermera, Maubisse & Bobonaro | Dili, Suai & Indonesia | Dili & Indonesia | Suai | Dili |
| Consumption level (kg/cap/year) | 90 | Na | 1.19 | Na | 2.22 |
| Export (national) | - | Na | Na | - | - |
| Demand (ton/year)<br>▪ Covalima<br>▪ National | <br>5406.70<br>95 992.40 | <br>Na<br>Na | <br>71.47<br>1269.20 | <br>Na<br>Na | <br>133.34<br>5256.5 |
| Supply (ton/year) | 10 335 | | 3445.5 | | 2241.1 |
| Average prices ($) | 0.60/kg | 0.75/kg | 6.50/kg (525/head) | 0.30/kg (0.40/kg dry) | 235/pig |

*Source: TLHS 2004; MAF; NSD & UNFPA; IMF 2011; Calisto 2014; MoF; DNAHE-MAF 2015; MAP Covalima 2017*

**Maize** - Table 5 shows more than 50 per cent of population in Covalima produce maize with the total production of 10 335 tons (MAP Covalima 2017). The main market for maize is Ermera, Maubisse and Bobonaro. An interview with maize producers in Covalima describe traders from those areas come regularly to Covalima looking for maize to purchase; and the average price is 0.60 cents per kilogram ($15/sack of 25 kg).

With the consumption level of 90 kilogram of maize annually, the demand for maize is around 5400 tons per year. This indicated that there is enough production to fulfill the demand needed (see Table 5). Based on the total production, there is still surplus of maize of around 5000 tons per year. If this volume is to be sold with the price of 0.60/kg it will generate a total value of 3 million dollars. Table 7 shows the demand forecast for maize in Covalima from 2017 – 2022.

Table 7. Demand forecast for maize in Covalima from 2017 – 2022

| Description | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Population - 2010 | 68 229.9 | 69 396.6 | 70 563.3 | 71 730 | 72 896.7 | 74 063.4 |
| Demand (t) (demand/cap/yr. of 90 kg) | 6140.7 | 6245.7 | 6350.7 | 6455.7 | 6560.7 | 6665.7 |

*Source: Population projection derived from NSD 2010; demand for maize are calculated*

With the current production level of maize in Covalima as mentioned it is clear that Covalima still able to supply the demand of maize for its population in the next six years to come. Even though the consumption level of maize rise up to 100 kilogram per capita per year, the demand for maize in the next six year will reached 7406.3 tons; This volume still under the current production of maize in Covalima.

**Mungbean** - It is one of the potential products in Covalima. It's nearly a half of household in this area grown mungbean as a source of income for their families. This product generally produces by farmers in lowland areas. The total production of mungbean is 413.6 tons (NSD and UNFPA 2015) and most of the product is for selling to the market. The main market for mungbean is Dili and Indonesia. In the past the existing market for mungbean includes Timor Global, Leo Atsabe, Ltd., ASC Maliana, Joel Hasil Bumi, Conico Ltd., and Caracoal Ltd.

In the last few years, because of the lack of access to Indonesia market, it makes it harder for these firms to continue engage in trading of mungbean products. This directly or indirectly affected the income received by producers in Covalima. On the other hand, the demand for mungbean in Indonesia is around 50 000 tons/year (Dirjen Tanaman Pangan 2012). To fulfill this demand, they imported mungbean from Etiopia, Myanmar, Thailand, Australia and Brasil. Indeed, Timor-Leste has the ability to produce mungbean for Indonesian market and it close to the border.

This is an opportunity for producers to grow more mungbeans as a cash crop for the domestic and export market. In addition, this product also contains high protein food for nutrition programs and therefore needs to be exploring in the future.

**Cattle** - Another potential livestock product from Covalima is cattle. It's around 20 percent (NSD 2015) of household in this area raise cattle with the total number of 34 455 head; and the average owned cattle per household is around 5 cattle's. The main purpose of raising cattle in Covalima is for selling to the market; and the main market is Dili and Indonesia market (hide market-through border). In Indonesian time cattle traders from Atambua and Kefamenanu came regularly to Covalima to buy cattle and distributed to Surabaya. After Independence cattle producers sold their cattle to CCT as the main buyer. In the past few years until present traders from Atsabe, Bobonaro and Ainaro normally bought cattle in Covalima and sell it to Dili; and only a small number of cattle sell in local market in Covalima. The average price of bovine meat in Covalima is $6.50/kg ($525/cattle).

Based on the level of consumption, the demand for bovine meat in Covalima is only around 71 tons per year. With the total production of cattle of 24 455 head (assume one cattle produce 100 kg carcass) it means cattle producers in Covalima can supply around 3445.5 tons of bovine meat annually. This is far beyond the demand that exist in Covalima and is able to fulfill the demand for bovine meat nationally.

**Cassava** - Farmers in lowland and upland areas around Covalima largely grow cassava. It is one of the top five potential local agriculture products and also as important subsistence crops in Covalima. Total household engage in the production of cassava is 6248 with the total production of around 11 500 tons per year.

Most of the cassava produce is destined for family consumption with only small quantities is distributed to the local market in Suai. The main market for this product is local market in Covalima. Cassava distributed to the market composed of fresh and dry cassava. The average price for fresh cassava is 0.30/kg, and dry cassava 0.40/kg ($15/a sack of 35 kg). In the past, CCT has been purchasing dried cassava, but because of the price paid is very low ($ 0.16 cents/kg at the farm gate) therefore it was not attractive to motivate farmers to produce for this market.

**Pig** - The objective for farmers raise pig in Covalima is to sell to the market and also for cultural/traditional ceremonies. Covalima has a high number of pig totaling 44 822 with the average owned per household is around 4 pigs. The average price for pig is $235. In addition, the demand for pork in Covalima is small around 133 tons per year; while from the supply side it can offer 2241 tons annually. This indicated that there is an opportunity to supply pigs from Covalima to other municipalities including Dili and also neighboring countries.

### 7.3.3 Potentiality of Local potential agriculture products and livestock in Baucau

Baucau is the second-largest city in Timor-Leste, after Dili, the capital, which lies 122 km east of Dili. The total area is 1,507.95 $km^2$ with the total population of 111 484 and the total household of 22 976 (NSD 2015).

It is an important food-producing area, where rice accounts for nearly half of aggregate cereal production, the remainder being maize. In addition, the municipality is an important producer of beans, groundnuts, cassava, sweet potatoes, copra and candlenut. Main livestock are buffalo, cattle and goats. Compared to other municipalities, Baucau is agriculturally more developed and has a surplus production.

As a municipality that will become a place for establishing cement factory called "Timor Cement" in the future, this will provide more jobs and more people will come to Baucau. This will result in the demand of locally agriculture products and therefore it is important to anticipate the supply in terms of quantity, quality and continuity of local products.

The result of the study shows that the top five potential local agriculture products and livestock identified in the municipality of Baucau is ***rice, sweet potato, maize, peanuts and tomato.*** These products are very potential in Baucau due to the agronomic condition that is favorable, farmers experience, good access to market, and for some of the products it can produce year round production. The details of the local potential agriculture products and livestock in Baucau are shown in table below.

Table 8. Description of local potential agriculture products in Baucau

| Description | Potential local agriculture products | | | | |
|---|---|---|---|---|---|
| | **Rice** | **Sweet Potato** | **Maize** | **Peanuts** | **Tomato** |
| Household number | 9300 | Na | 12 338 | Na | Na |
| Total production | 26 350 t (15 810 t) | 14 328 t | 10 290.1 t | 15.8 t (10.3 t) | 950 t |
| Productivity (t/ha) | 2.50 | Na | 2.08 | 1.86 | 5.40 |
| Main market | Dili | Dili | Dili & Baucau | Dili | Dili |
| Consumption level (kg/cap/year) | 95 | | 105 | Na | Na |
| Export (national) | - | - | - | - | - |
| Demand (ton/year)<br>▪ Baucau<br>▪ National | <br>10 591<br>101 325.3 | | <br>11 705.8<br>111 991.1 | <br>-<br>- | <br>-<br>- |
| Supply (ton/year) | 15 810 | 14 328 | 10 290.1 | 10.3 | 950 |
| Average prices ($) | 0.45/kg | 0.35/kg | 0.50 | 0.60/kg | 0.88/kg |

*Source: TLHS 2004; MAFF; NSD and UNFPA; RDTL; IMF 2011; FAO 2011; MoF and MAP 2014; MoF; DNAHE-MAP 2015; Correia et. al 2015; MAP Baucau 2017 # Paddy rice is 60%; Peanut shelled is 65%*

**Rice -** It is the preferred staple for most people in Baucau both in the urban and lowland areas. It is both a food crop and a cash crop. The dominant rice systems in this area are rain fed lowlands and rain fed uplands. The potential cultivated area of paddy rice is 14 400 hectares, but only 8100 hectares are planted (56 %). In 2015 this

cultivated area produced 26 350 tons of paddy rice (MAP, 2015). This means the abandoned land for paddy rice cultivation is 6300 hectares or around 44 per cent of the total potential area exists. In addition, the productivity of paddy rice in Baucau is 3.3 tons per hectare (MAP Baucau 2015). If Baucau can manage to cultivate all the remaining potential areas, it will produce a total of 20 790 tons of paddy rice with the total value of US$8 336 000 in revenue ($400/ton).

With the per capita consumption of rice of 95 kilograms per year, it means Baucau will need around 10 591 tons of rice annually. This indicated the current production of rice can fulfill the demand as the total supply per year is around 15 810 tons' rice; this means there is surplus of around 5000 tons of rice (demand forecast see Table 9). The average price for paddy rice is 0.45 cents per kilogram, while for rice is $1.10 per kilogram ($11/sack of 10 kg). The main market for rice is Dili with a small quantity sell in Baucau market.

Table 9. Demand forecast for rice in Baucau from 2017 – 2022

| Description | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Population - 2010 | 124 009.1 | 125 798.4 | 127 587.7 | 129 377 | 131 166.3 | 132 955.6 |
| Demand for rice (t) (demand/cap/ year of 95 kg) | 11 780.9 | 11 950.8 | 12 120.8 | 12 290.8 | 12 460.9 | 12 630.7 |

*Source: Population projection derived from NSD 2010; demand for rice are calculated*

In terms of Baucau supply chain for rice it composed of formal and informal supply chains (see Figure 2). In formal chain, producers sell their paddy rice to processors (ACELDA), who process it (milling, packing, transporting, etc) into rice and distribute to retailers and end consumers both in Baucau and Dili. ACELDA is a local business firm that operates in the agricultural sector. Its activities also include buying and selling of paddy/rice. Meanwhile, for the informal chain, producers sell their paddy rice to their neighbors. The volume of the product sold per transaction is very small compared to the volume marketed in the formal chain.

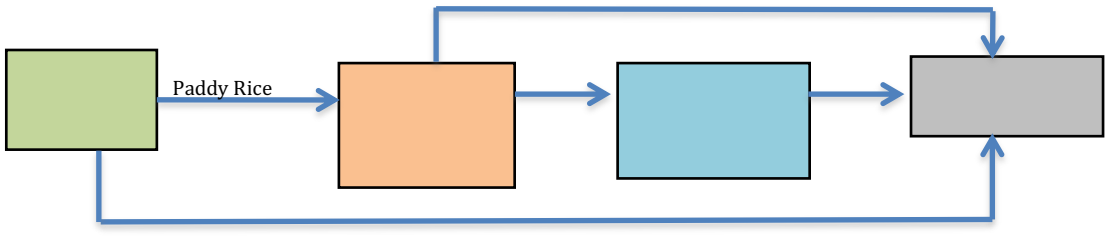



Figure 2. Supply ch

**Sweet Potato –** It is another local potential agriculture products in Baucau. Farmers can produce this product for year round production and most of the produce (75%) is for home consumption and the rest is destined to market. The

total production of sweet potato in Baucau in 2016 was 14 328 ton (MAP Baucau 2017). The average price for sweet potato is 0.35 cents per kilogram and the main market is Dili and Baucau.

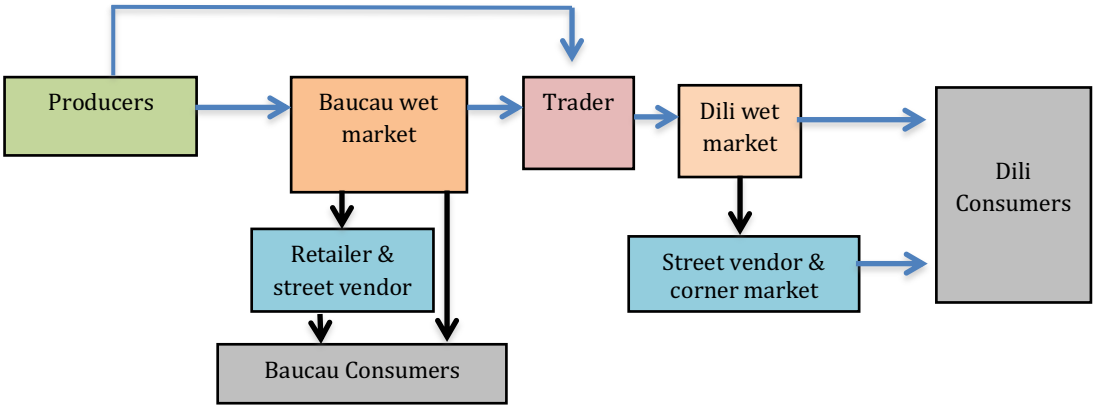



Figure 3. Supply

**Maize** - One of the potential local agriculture products for Baucau is maize. It is around 12 000 household (58% of total household in Baucau) engage in the production of maize. The total production in 2017 is 10 290.1 tons of maize grain and the productivity is 2.08 tons per hectare (MAP Baucau 2017). Most of maize produce (80%) is for home consumption and the rest is for selling to the market and feeding livestock.

**Peanuts** - Baucau is known as a center for peanuts production in Timor-Leste; therefore, it becomes one of the potential products in this area. Peanuts are usually grown as a cash crop, and farmers in Baucau produce this product under rain fed conditions, with little inputs. The product produce is generally for sale to the market, providing some source of cash income for rural households. The main market is Dili; and the average price is 0.60 cents per kilogram. The main production areas for peanuts in Baucau are including Gariwai (Baucau Vila), Fatulia (Venilale), Uaitame (Baguia) and Ostico and Uatulari (Vemasse). The total production in 2015 was 15.8 tons with the productivity of 1.86 tons per hectare (SoL 2015). Planting season for peanuts in Baucau is November – December and the harvesting time is in March – April.

**Tomato** - In the past few years until present, Baucau become one of the main suppliers of tomato to Dili market. The potential areas for producing tomato include Buruma, Triloca, Bucoli, Caibada, Fatumaca and some parts of Venilale. Through the interviews with stakeholders in Baucau it reveals that tomato is one of the local potential agriculture product in this municipality. The total production of tomato in 2015 was 950 tons (Direcao Statistica Municipio Baucau 2015) with the yield of 5.4 tons per hectare. This yield is higher than national average, which is only accounted for 1.8 ton/ha (MAFF 2009).

In addition, most of the production is distributed to the market; and the main market is Baucau and Dili market. The average price for tomato is slightly different between peak and low season. In peak season the average price is 0.62 cents per kilogram and in low season is $1.15 per kilogram. It is clear that peak and low season of producing tomato directly affect the price. If assume that from the total production of 950 tons, only 75 per cent is marketed with the average price of 0.62 cents per kilogram, it will generate annual revenue of $ 441 750 dollars. In terms of supply chain for tomato in Baucau is shown in figure below.

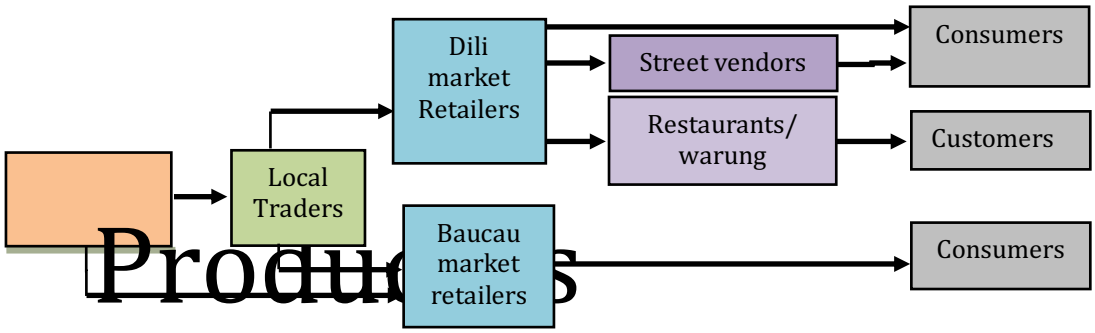



Figure 4. Supply chain of Tomato in *Baucau*

### 7.3.4 Potentiality of local potential agriculture products and livestock in Bobonaro

The municipality of Bobonaro is one of the municipalities in Timor-Leste located in the western part of the country and sharing a border directly with Indonesia. In the north part it's bordered with Liquica, in south part bordered with Covalima and in the west bordered with NTT Indonesia. The total area is 1,380.82 km2 with the total population of 7,762 people and the total household of 17,635 (DGE 2015). Bobonaro is constituted of six sub-districts and 50 villages with the population density of 71 people/km2.

Agriculture becomes an important source of income and livelihoods for the majority of population in Bobonaro. The total area suitable for agriculture is approximately 25,000 hectares or around 18.1 per cent of the total area. The major crop cultivated by farmers includes paddy rice, maize, mustard, cabbage, shallot, garlic, and others. In addition, livestock raised are including cattle, buffalos, goat, horse, pig and chicken. Most of the agricultural system applied is still subsistence with some slightly moving away from subsistence to semi and commercial farming.

The result of the study shows that the top five (5) local potential agriculture products and livestock in the municipality of Bobonaro are **Paddy Rice, Maize, Mungbean, Cattle and Shallot.** From the discussions and interviews with stakeholders it reveals that these products play an important role in the economy of the majority of population in Bobonaro. The existing market for these products domestically is quite

good, the engagement of people in Bobonaro in producing these products is significant, and some of the products in the past have being exported to Indonesia (e.g., cattle and green bean).

**Paddy Rice** – Bobonaro known as one of the municipalities in Timor-Leste, which is very potential for paddy rice production. Since Indonesian times until recently, Bobonaro still become the center of paddy rice production in this country. This can be seeing through the significant involvement of the household in producing paddy rice, which around 8,500 households or 48.2 per cent of the total household in Bobonaro (DGE 2015). In addition, the productivity of paddy rice is also increase up to 3.6 ton/ha compared to national level, which only achieved around 2.5 ton/ha (DSA Bobonaro 2019 & MAP 2015). Despite this, there are two permanent irrigation schemes (Maliana I and Maliana II) that provide water continuously for the whole year in supporting the production of paddy rice in this area.

The potential area for paddy rice cultivation in Bobonaro is 7762 hectare hectares, but only around 3,500 hectares are planted (45.1%). The area planted for paddy rice in Bobonaro in 2016 was 866.40 hectares and in 2019 was 3503 hectares (MAP Bobonaro 2019). This means there is an increase of the area of production of 2,657 hectares (75%) during four years' time. The increase in area planted resulted to the increase in production and productivity. For instance, the production of paddy rice in 2017 was 6,974.19 tons with the productivity of 3.28 tons/ha, and in 2018 it was increase up to 11,395 tons with the productivity of 3.6 tons/ha (an increase in the productivity of 0.32 ton/ha). The details of the area planted and production of paddy rice are shown in Figure 5.

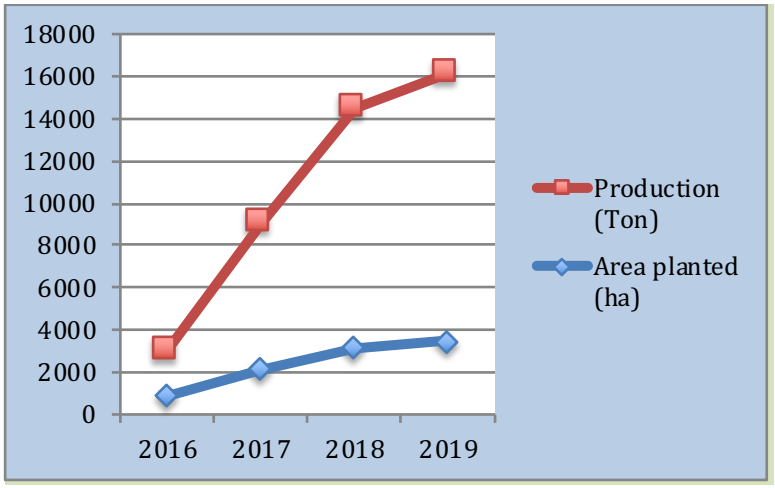



Figure 5. Area planted and production of paddy rice in Bobonaro (2016 – 2019)

If the per capita consumption of rice of 95 kilograms per year it means Bobonaro will need around 9287 tons of rice annually. In fact, the current production of paddy rice

in Bobonaro in 2019 is 12,641 tons or equivalent to 7584.6 tons of rice. This indicated there is a deficit of the supply of rice of around1700 tons per year.

Most of the production of paddy rice produced (65%) still for own consumption, and the rest is distributed to the market. The main market is Liquica, Ermera and Dili. In terms of local market, the demand is quite significant as Liquica and Ermera does not have enough suitable land and irrigation to produce rice. Therefore, most of the rice produced in Bobonaro generally bough by people from these two municipalities. There is only a small number of volumes are further distributed to Dili market in particular for red and black rice. The average price for paddy rice is 0.40 cents per kilogram, while for rice is $1.05 per kilogram ($26/sack of 25kg). In addition, in recent years there is market opportunities offered by government (CLN) to buy locally produced rice, and this provides an opportunity for producers in Bobonaro to produce more for the market.

Based on the total production of paddy rice of 12,641 tons, and assume 60 per cent is sold to the market with the price of $400/ton; this will generate an income of $5,056,400 ($594.9/household/season).

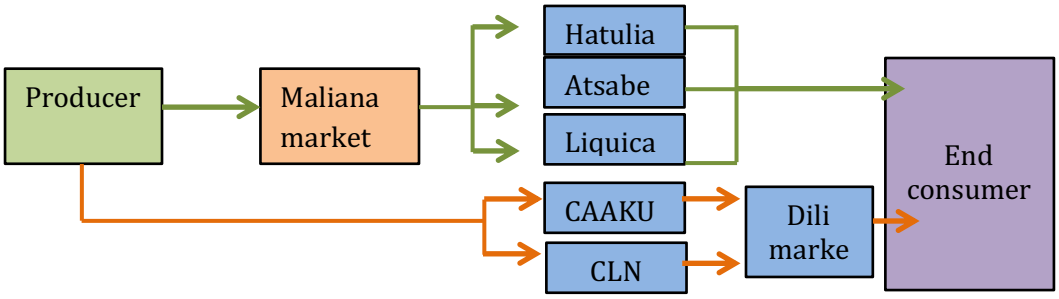



Figure 6. Supply chain of paddy/ rice in Bobonaro

**Maize** – It is a product that engages more than 15,000 households in Bobonaro to produce. Maize is the second potential product after rice with around 85 per cent of the population planted every year. The total area planted in 2018 was around 9000 hectares and 2019 down to 6507 (MAP Bobonaro 2019). Even though the area planted decrease however, the production and productivity of maize increase significantly. For example, the production in 2018 was around 19,700 tons and in 2019 rise up to 24,500 tons (increase by 4800 tons). If Bobonaro can maintain an increase of maize annually it means in the next 5 years Bobonaro alone can produce more than 48,500 tons of maize.

With the level of consumption of 90 kilograms per capita per year, it means the demand of maize for Bobonaro is 8798.6 tons per year. Thus, with the current level of production of 24,575 tons in 2019, there is an oversupply of about 15,776.4 tons annually. If this surplus can be sold with the price of $400 per ton it will generate an

income of around 6 million US dollar per year or $417 per household per year. The main market for maize is Ermera and Liquica. These areas topographically are located in highland areas where the production of maize is very low and take more than 4 months to produce. Indeed, traders and consumer generally bought maize in small quantity. The price of maize is 0.40 cents per kilogram or $400 per ton.

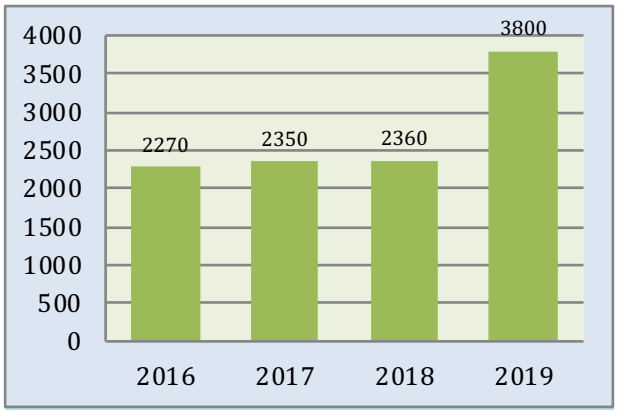



Figure 7. Productivity of maize in Bobonaro

**Mungbean** – One of the local potential agriculture products in Bobonaro is Mungbean. There is no information on how many households producing mungbean, however there is a total of household produce beans of 10,063 (DGE 2015) and this may include mungbean. The potential area for mungbean in Bobonaro is 1467 hectares but the area planted is only 686 hectares (MAP Bobonaro 2011; 2019) or it is only 47% of the total potential area planted. In terms of the total production, it's around 550 tons per year with the productivity of 1.10 tons per hectare. The productivity of mungbean is very low however; it is higher than the national average of 0.90 tons per hectare (MAP 2012). If Bobonaro can maximize all the potential areas it will produce around 770 tons of mungbean annually; or, if producers can increase the productivity of about 2.5 tons per hectare it will produce around 3,600 tons per year.

The main market for mungbean is Maliana, Dili and Indonesia with the average price of $1.25 per kilogram. With the total production as mentioned it can generate an income for producers of $687,500 annually. In addition, the main production area for mungbean is Maliana, Balibo and Bobonaro.

**Cattle** - Bobonaro is one of the three municipalities in the west part of Timor-Leste, which is very Potential for cattle production. The total number of household raised cattle is 8489 households (48.1%) with the total number of cattle of 37,052 (DGE 2015). This indicates that each household raises around four cattle's.

The system of raising cattle composed of two ways. The first, producers generally raise their cattle's in an open field for the whole day than penned at night. This mostly applied for producers who owned more than five cattle's. The

second way is through fattening system which producers manages their cattle's in an intensive way including feeding three times a day and others.

The main market is Dili and Indonesia; with the latest trading illegally through the border (Scott at al. 2016) and the number is quite significant. The main buyers are traders who regularly buy and distribute cattle's to the main market and the volume of trading is very small around 10 – 12 cattle's per week (Scott et al. 2016). With the national consumption level for bovine meat of 1.19 kg/cap/year (Varela 2014), this means the demand for bovine meat in Bobonaro is 116.2 tons per year. The per capita consumption of meat as mentioned is quite lower; compared to Indonesia of 2.5 kilogram and an average of least developed countries of 4.8 kilograms. The lower consumption of bovine meat is caused by low income which affect to the consumer buying power, and also consumer preferences to buy other meat which quite cheaper. Indeed, the mean per capita income per month in Timor-Leste is quite lower of $62; which for urban areas $93 and rural areas $50 (NSD 2011). The average price is $550 per cattle ($7.50/kg bovine meat).

Based on the total number of cattle in Bobonaro of 37,052 or equivalent to 3705.2 tons of meat (100 kg carcass weight), it means there is more than enough to supply bovine meat to the population in Bobonaro (demand only 116.2 t/year). The oversupply of bovine meat of 3589 tons can be further supply to the main market in Dili and other municipalities. In addition, the demand for cattle in Indonesia is quite big as the domestic production of cattle in Indonesia can only fulfill about 45% of the Indonesian demand for beef (Agus & Widi 2018). As a result, in 2016 Indonesia import 195,764,113 cattle and mostly from Australia.

The high demand of beef market in Indonesia offered an opportunity for Timor-Leste beef industry - as there is an oversupply of beef in Timor-Leste of about 20,000 tons (DGE 2015). This can be further exploited as a potential market for cattle export.

In fact, Timor-Leste produces enough beef to be self-sufficient, however lack of demand, low purchasing power and lack of capacity to meet the supermarket and high-end hotel, restaurant and institution (HRI) trade; means Timor-Leste still imports some beef in particular from Australia and New Zealand of around 100 tons per year (UNComtrade 2015).

From census data 2015 shows that 25.8 per cent of all households (52,864 households) in Timor-Leste raised cattle, totaling 221,767 head (DGE 2015) with more extensive production areas including Bobonaro, Covalima, Oecusse and Manufahi. The detail for cattle production indicators in Timor-Leste is presented in figure 8.

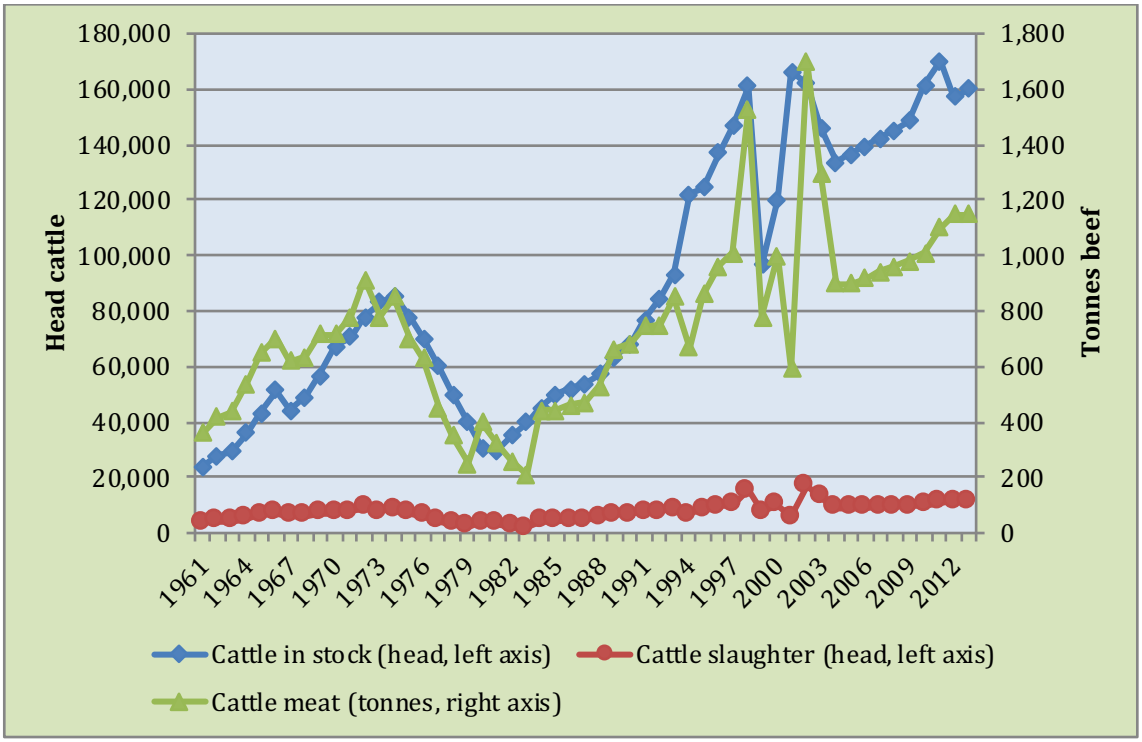



Figure 8. Cattle and beef industry indicator in Timor-Leste

**Shallot** – Another potential product in Bobonaro is Shallot. The area where communities mostly produce shallot is in Posto Administrativo Bobonaro (Marobo complex), Maliana and Balibo. The Potential area for shallot is around 600 hectares and there is only 60 per cent (360 ha) are planted (MAP Bobonaro 2019). In addition, the productivity of shallot is 1.2 tons per hectare.

The main market is Bobonaro and Dili. However, the volume of the product distributed to the market is small as there is lack of buyers and most of the product sold only in Bobonaro. Buyers are including traders, retailers and consumers in Bobonaro. The price of shallot is US$1.50 per kilogram. Indeed, shallot is in high demand in Indonesia. This is related to the importance of this product as a key ingredient for Indonesian cuisine. From 2008 – 2012 the national consumption of shallots averaged 1.04 million tons per year (AIP-PRISMA 2015). In terms of imports it accounted for 7-15% annually (average 110,000 tons/year) and most of shallot is imported from Thailand, Philippines, Vietnam, India and Myanmar. This is another important market that Timor-Leste can exploit. Timor-Leste has plenty of potential areas to produce shallot including Bobonaro and geographically it's very close to Indonesia. If Timor-Leste can maximize its effort to fulfill some of the demands of shallot in Indonesian market it will generate significant income to the country. Table below present a summary of the local potential agriculture products and livestock in Bobonaro.

Table 10. Description of local potential agriculture products and livestock in Bobonaro

| Description | Potential local agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | Paddy Rice | Maize | Mungbean | Cattle | Shallot |
| Household number | 8500 | 15,128 | 10,063 | 8489 | Na |
| Current production (t/year) | 12,641 (7584.6) | 24,575 | 550 | 37,052 | 432 |
| Productivity (t/ha) | 3.60 | 3.80 | 1.10 | - | 1.2 |
| Main market | Ermera, Liquica & Dili | Ermera & Liquica | Dili & Indonesia | Dili & Indonesia | Bobonaro & Dili |
| Average price ($/kg) | 0.40 | 0.40 | 1.25 | 7.50 ($550/head) | 1.50 |
| Consumption level (kg/cap/yr) | 95 | 90 | Na | 1.19 | Na |
| Demand (t/yr)<br>Bobonaro<br>National | <br>9287.4<br>110,887.9 | <br>8798.6<br>105,051.8 | <br>Na | <br>116.3<br>1387.0 | <br>Na |
| Current supply (t/yr) | 7584.6 | 24,575 | 550 | 3705.2 | 432 |
| Export | - | - | - | - | - |

*Source: TLHS 2004; MAF; NSD and UNFPA; RDTL; IMF 2011; MAP 2012; Varela 2014; DNAHE-MAF 2015; DGE 2015; Scott et al 2016; MAP Bobonaro 2019 # Conversion paddy rice to rice is 60%;*

### 7.3.5 Potentiality of local potential agriculture products and livestock in Ermera

Ermera is one of the municipalities in Timor-Leste that is very potential for coffee production. Demographically Ermera is located at 8° 40-100' south latitude and 125° 01-35' east longitude. Ermera consists of five sub-districts namely Atsabe, Letefoho, Hatolia, Ermera, and Railako. Topographically, Ermera is divided into four areas according to altitude: 1) areas with altitude of 40–100 m including Hatolia, Sare, and Marobo River; 2) areas with 100–500 m altitude in Hatolia town; 3) areas with 500–1000 m altitude including Tallo, Fatubesi, Ermera and Railako; and 4) areas with more than 1000 m altitude including Atsabe and Letefoho. The total area of Ermera is 770.83 km2 and the total population of 125,702 (second highest after Dili) with total household of 20,671 (DGE 2015).

The main crops grown by farmers include coffee, maize, vegetables (e.g., cabbage, carrots, mustards, broccoli, etc), vanilla, fruits (e.g., tangerine, rambutan, mango, etc), beans and so on. Meanwhile the livestock mostly raised by farmers are including cattle, chicken, pig and goat. The rainy season started from October to March and the dry season is from April to September.

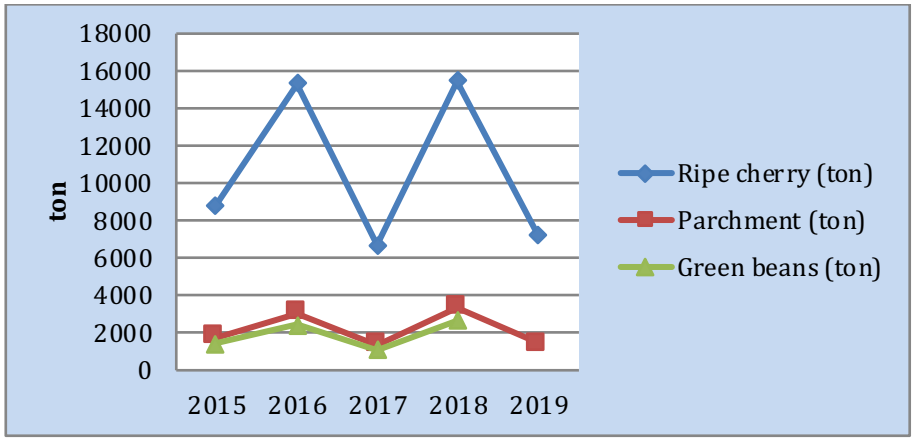
The result of the study revealed the top 5 local potential agriculture products and livestock in Ermera are **Coffee, Vanila, Tangerine, Shallot and cabbage**. These are products that contribute significantly to the economy of the population of Ermera and also engages a significant number of farmer households in producing these products. Stakeholders interviewed mostly describe these products as potential local products in Ermera that can be developed further in particular increasing the productivity and also the market.

**Coffee** – So far coffee still become the major export for non-oil commodity in Timor-Leste. The production of coffee including Ermera is dominated by an estimated 44,000 small household producers which represent around 25 per cent of the total population in Timor-Leste (Oxfam 2002); and in Ermera alone, this commodity engages approximatelly 16,939 household in the sector (DGE 2015). In terms of the area of coffee in Ermera, there is an estimated of 28,000 hectares, or 58 per cent of the total area coffee plantations in Timor-Leste (MAFF 2010). Even though coffee still remains as Timor-Leste's major export, the contribution of this sector to the national economy is very important and in terms of the income, it offers to a significant proportion of the rural population.

The study reveal that the current production (netto) of coffee in Ermera is 9,760,999 kilograms (or 9761 tons) per year with the productivity of 0.65 tons per hectare (CCT; MAP Ermera 2019). From the interview and discussions with stakeholders, the majority of them are really concern with the the low production of coffee – which continue to decrease. Howerver, there are a number of measure that has being implemented by MAP and CCT to increase the production and this includes the rehabilitation of old coffee trees (pruning), distribution of coffee nursery and others. So far there are around 600 hectares of coffee that has being rehabilitated (MAP Ermera 2019). According to coffee and cacao expert Mr.Soebadi (CCT consultant), coffee that has being pruned can increase the production by 200 per cent or on average 10 kilograms per coffee tree. In addition, in the last 4 years around 3 million coffee threes that has being pruned by CCT in coffee production areas in Timor-Leste. If prune can increase production as mentioned, it means the productivity of coffee in Ermera will rise up to 1.95 tons per hectare. This will resulted in the increase of production by 54,600 tons annually.

Most of coffee produced in Ermera is destined for export. There is only small percentage of coffee is marketed domestically. The total export of coffee from 2015 – 2019 is always fluctuated. For example, in 2017 and 2018 the volume of export for parchment was 1339.72 and 3338 tons respectivelly (CCT 2019). The export destination countries are including USA, Canada, Australia and Japan. The details of the export of coffee in Timor-Leste is shown in figure 6. In addition the main buyers and exporters for coffee in Ermera are CCT–NCBA, Timor Global, Timor Corp., Peace wing Japan, Olam, Alter Trade and Parchic. The average price for coffee cherry is 0.34 cents/kg. For coffee with quality grade 'A' the price is vary. For example, Olam company offer $2.25/kg, Timor Corp $2.50/kg and Peace Wing $2.75/kg.

The demand for Timor-Leste's coffee is high, however the production is very low. To fulfil the demand for export market, improving the productivity is an option that need to be taken into consideration.




*Source: CCT 2019*

Figure 9. Export of coffee from 2015 - 2019

**Vanilla** - Vanilla is a second local potential agriculture product in Ermera. Vanilla was re-introdfuced as a cash crop by CCT in 1996 and started from 2002 – 2005 began to export the product which internationally certify as "organic product". The total area of vanilla in Ermera is around 60 hectares and the total household involve in growing vanilla is 227 households (MAP Ermera; CCT 2019).

The production of vanilla from time to time is vary. For example, in 2015 was around 700 kg, 2017 was 145 kg and 2019 rsie up to 6025 kg (CCT 2019). The details of the production of vanilla from 2010 – 2019 is shown in figure 7.

In addition, most of the vanilla produced is destined to the export market. So far the main buyers for this commodity is CCT/NCBA and the main market is USA and New Zealand. The price of wet vanilla in 2018 for grade A was $57/kg and grade B $45/kg. In 2019 the price going down slightly to $50/kg for grade A and $40/kg for grade B. Compared to the price of wet vanilla in 2005 of $22.50/kg (Correia et al. 2005), the current price increase significantly by 45 per cent in 14 years time.

The result of the study shows one vanila tree can produce an average of 1.8 kilograms wet vanilla. From the interview with a group of vanilla farmers in Suco Leimea Sorin Balun, it reveal that from 225 vanilla trees can only produce 405 kg vanilla. This group planted around 15 hectares of vanilla. In addition, with the planting distance of 2 x 2 meters, one hectare can be planted 2500 vanilla tree (4500 kg/ha).

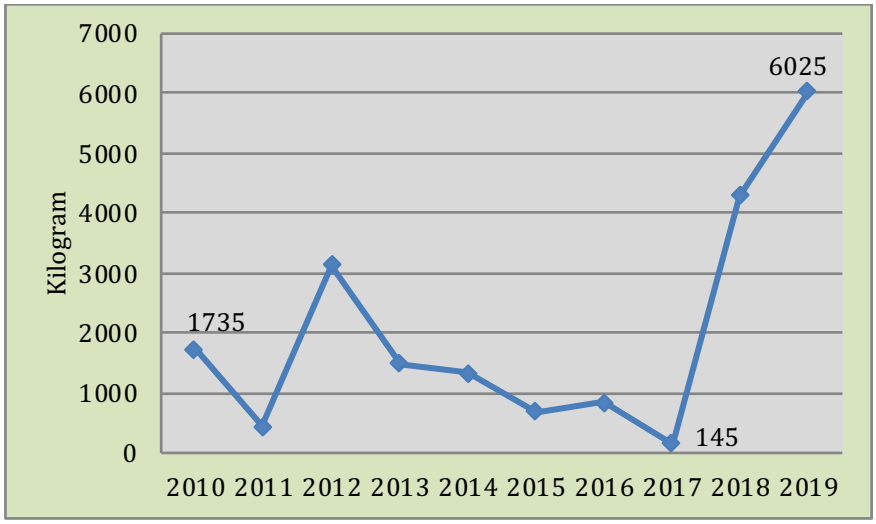



Figure 10. Production of Vanilla in Ermera (2010 -2019)

With the current production of 6025 kilograms and the average price of $45 per kilogram, this will provide a revenue of $271,125 per year ($1,194.4/household/year). If vanilla farmers can maximize the area of planted of 60 hectares it means the production of vanilla in Ermera will reach around 12 million dollars annually. Based on the information as mentioned, the development of vanilla in Ermera will have a good prospect in the future. From the agronomic aspect, the topography of Ermera is feasible from growing vanilla as the cultivation of this plant requires a temperature range of 21 to 32 °C, an evenly distributed annual precipitation of 1500 mm or more, 80 per cent relative humidity and altitudes of 0 to 600 m above sea level (FAO 2009). From the economic aspect it provides a significant revenue and this futher resulted in an increase of income of the population in Ermera.

**Tangerine** - It is a commodity that growing well in Ermera as this plant can be grown in low land and also up-land areas. Data from the Ministery of Agriculture shows that the potential area for tangerine in Ermera is around 5000 hectares (MAP 2014); however it is only planted 87.65 hectares (MAP Ermera 2019). In addition, the total production in 2012 was 505.47 tons and 2013 down to 252.7 tons (MAP 2014). In terms of the productivity, it is around 3 tons per hectare; and this is very low compared to Indonesia of 21 tons per hectare. Areas where tangerine mostly grown are including Humboe, Mertutu, Railaco, and Letefoho.

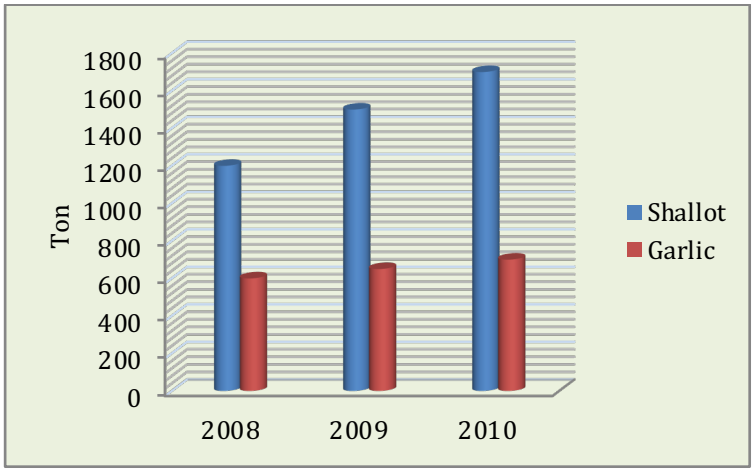
Most of tangerine produced in Ermera is distributed to Dili with the rest is selling to the local market around Ermera and other municipalities. For prices, producers normally sell one tree of tangerine ready for harvest for $100-200/tree (one tree can produce an average of 35 kg of tangerine). This means one kilogram of tangerine can be sold by 0.23 cents per kilogram. According to Badang Litban Pertanian (2012), one hectare can be planted 500 tangerine trees. With the average price of $150 per tree it can generate an income of $75,000/year. Thus, if the average productivity of 21 tons per

hectare, with the total planting area of 87.65 hectares Ermera can produce around 1840.7 tons tangerine per year. Furthermore, the maximization of a half of the potential areas for tangerine in Ermera (2500 ha) it will produce 52,500 tons of tangerine per year.

**Shallot** – These are some of the commodities that are very potential in Ermera. Shallot growing well in Ermera and the majority of producers are small-scale farmers who produce only in a small area of land averaged 0.2 hectares. The total area planted for shallot is 11.3 hectare (DNAH-MAP 2007).

The total production of shallot in Timor-Leste is around 1700 tons (see figure 8); and for Ermera it is around 35 tons (DNAH-MAP 2007; 2010). In addition, the productivity of shallot in Ermera is very low accounted for only 3.1 tons per hectare. If compared to Indonesia, the productivity of shallot is 9.31 tons per hectare (BPS & Dirjen Hortikultura 2017). This indicated that there is still rooms to increase production of shallot. Indeed, there is lack of data on the potentiality for these commodities; but through the discussions and interviews with stakeholders, around 80 per cent of them stated that shallot are very potential in Ermera.

Most of shallot produced is sell to the local market in Ermera and other municipalities - where cheaper import of shallot has not penetrated yet; and a small percentage is distributed to Dili market. In the local market, most of the products are sold in volume (e.g., cans, sacks, buckets and bunches); and the price for shallot is $1.50 per kilogram (harvest season). This price will rise-up to $2.25 per kilogram in a few months later. With the price of $1.50/kg it can generate an income for producers of $52,500 per year. The main buyers are traders who engaging in buying and selling of agricultural produce.




*Source: DNAH-MAP 2010*

Figure 11. Production of Shallot and Garlic in Timor-Leste from 2008-2010)

**Cabbage** – Another potential local product in Ermera is Cabbage. The total household engage in vegetable production in

Ermera is 13,639; and from this, around 6800 (50%) involve in the production of cabbage. According to MAP (2007) the total area planted for cabbage in Ermera is 50 hectares with the total production of 390 tons. In addition, the production of cabbage from 2014 – 2018 shows significant increase. For example, in 2017 the production was 219.65 tons and in 2018 rise up to 667.6 tons (MAP Ermera 2019); an increase of about 33 per cent. The yield of cabbage is 7.8 tons per hectare. According to FAO (2006) and MAC (2008), under good growing conditions and use of good seed varieties, cabbage can yield up to 20 tons per hectare. The details of the production of cabbage in Ermera is shown in grafic below.

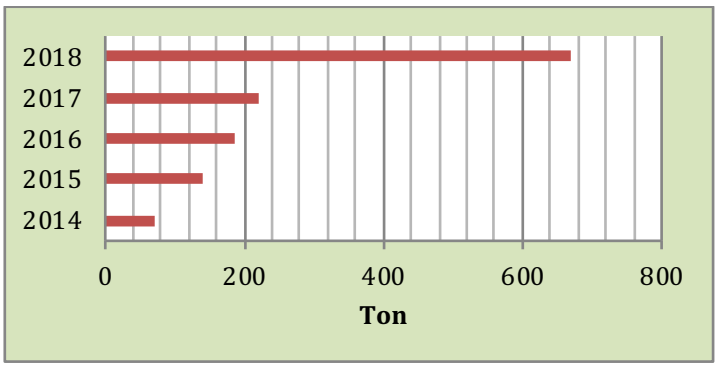



Figure 12. Production of cabbage in Ermera (2014-2018)

The main market for cabbage is Dili and the main buyers are local traders and supermarkets. Traders normally bought in bulk or in advance payment when producers started to grow cabbage. Meanwhile some supermarkets operated regularly in a weekly basis to purchase cabbage and other vegetables. Most of the cabbage produced in Ermera is sold in the market, with the average price of 0.50 cents per kilogram. From the total production as mentioned, it can generate a total value of about $300, 000. Cabbage alone could provide a substantial improvement in income of farm households in the Ermera. The details of the local potential agriculture products and livestock in Ermera are shown in table 11.

Table 11. Description of local potential agriculture products and livestock in Ermera

| Description | Potential local agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | Coffee | Vanilla | Tangerine | Shallot | Cabbage |
| Household number | 16,939 | 227 | Na | Na | 6800 |
| Current production (t/year) | 9761 | 6.02 | 505.5 | 35/29 | 390 |
| Productivity (t/ha) | 0.65 | 4.5 | 3.0 (21) | 3.1/0.93 | 7.8 |
| Main market | USA , Canada, Australia & Japan | USA & NZ | Dili & Ermera | Local market | Dili |
| Average price ($/kg) | 0.34/kg (cherry) | 45/kg wet vanilla | 150/tree | 1.50/kg | 0.50/kg |
| Consumption level (kg/cap/yr) | Na | Na | Na | Na | Na |
| Demand (t/yr) | - | - | - | - | - |
| Current supply (t/yr) | 9761 | 6.02 | 505.5 | 35/29 | 390 |
| Export (ton) | 10,712.7 (Ripe cherry) | 1.0 (dry vanilla) | - | - | - |

*Source: TLHS 2004; DNAHE-MAP 2007 & 2010; MAP 2014; DGE 2015; MAP Ermera 2019; CCT 2019 # Conversion – Wet to dry Vanilla is 6:1*

### 7.3.3 Potentiality of local potential agriculture products and livestock in Liquica

Liquica is one of the municipalities in Timor-Leste that is very close to capital city – around 45 minutes' drive from Dili. Administratively Liquica constituted of three Posto Administrativos and 23 villages of which 10 villages are located in coastal areas and the others in up-land areas. The total area is 550.95 square kilometer with the total population of 74,454 and the total household of 11,885 (DGE 2015).

The livelihood of most of the population depends on agriculture sector. This includes fisheries for communities live throughout coastal areas and crops and livestock production for those live in lowland up-land areas such as Lois and Bazartete. The crops mostly grown are including coffee, maize, cassava, paddy rice, vegetables, fruits (e.g., mango, tangerine, etc) and papaya. Meanwhile the majority of population in Liquica raises cattle, goat, chicken, pig and horse.

The result of the study shows the top 5 local potential agriculture products and livestock in Liquica are **Coffee, Banana, tangerine, cattle and maize**. According to the discussions and deep interviews with stakeholders it clearly stated that local products and livestock as mentioned are very potential in Liquica due to the community's dependency as source of income and food security, the existing market both domestic and export market, and the contribution for local economy and income.

**Coffee -** this commodity mostly grown by communities live in up-land areas with the household engages in coffee production of 6703 (DGE 2015). The total area is around 12,000 hectares with the production of 4050 tons and the yield around 0.52 tons per hectare (MAP 2015). Due to the coffee that is too old, lack of shade trees, changing in climatic condition and poor farm management, it's directly affecting the production of coffee. Most of coffee produced in Liquica is destined to export market with a very small percentage sold in domestic market. Main buyers are including CCT and Timor Global and the price offered to producers is 0.30 cents per kilogram cherry (or $1.40/kg dry bean).

**Banana** – It is one of the local potential products in Liquica, which employed a significant number of households to produce it. The average farm size is range from 0.2 to 2 hectares. In addition, the yield of banana is very low accounted for 0.91 tons per hectare (Correia et al. 2015); which considered lower than the average yield of most of bananas producing countries such as Philippines and Ghana of 13.3 tons per hectare (IFPRI; Bathan & Lantican 2010). The low production of banana mainly is due to lack of crop management, low skill of producers and intensive use of local seeds.

For areas with potential for banana production such as Loes the income of the majority of the population is generated from banana. This reflects by a large quantity of the products (95%) sold in the market (Correia et al. 2015). The main market for banana is Dili and the main buyers are local traders who regularly buying and selling of agricultural produce in Liquica. In addition, the average price of one big bunch of banana is $3.00 (one big bunch composed of 15 small bunches). The weight of a big bunch is 20 kilograms and small bunch is 1.34 kilograms. This means that the price of one-kilogram banana is 0.15 cents.

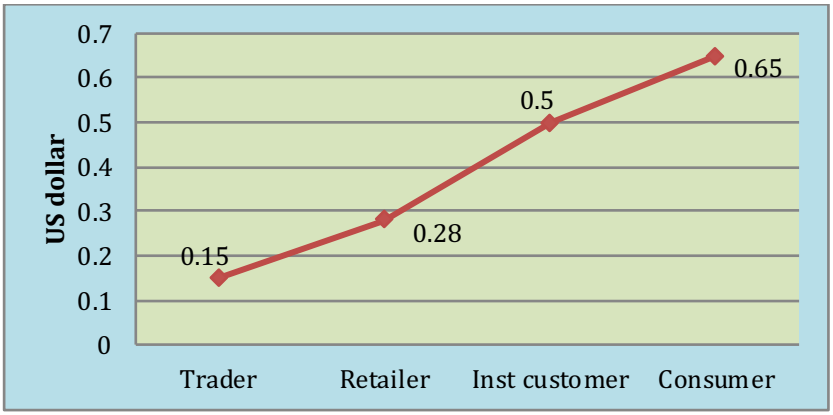



Figure 13. Average price of Banana

A study done by Correia et al. (2015) revealed that the quantity of banana sold by traders during peak season accounted for around 15 tons and in low peak season around 6 tons. In terms of the distribution system, most of the products mainly go

through local traders than Dili markets retailers and finally consumers as shown in figure below.

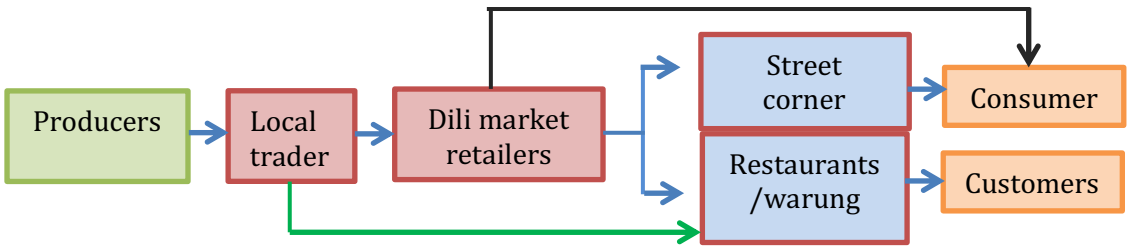



Figure 14. Supply chain of Banana in Liquica

**Tangerine** – Another local potential agriculture product in Liquica is tangerine. Data from Ministry of Agriculture and Fisheries shows the potential area for tangerine in Liquica is around 20,000 hectares. However, there are only 26.52 hectares or 0.13 per cent of the total area has being planted (MAP 2014). In addition, the production of tangerine was 291.72 tons with the yield of 11 tons per hectares.

Meanwhile, the result of the study revealed that with the planting distance of 6x6 meters farmers grow around 500 tangerine trees per hectare. This means with the total area planted as mentioned, there will be13, 260 tangerine trees are available in Liquica. Thus, with the average production of 35 kilograms per tangerine tree, this will have resulted in a total production of 464,100 kilograms or 464.1 tons of tangerine per year. Based on this, the yield of tangerine will be 17.7 tons per hectare and this is higher than national level but lower than tangerine yield in Indonesia which accounted for 32.5 tons per hectare (Departemen Pertanian 2009a) and this means there is still an opportunity for improving the yield of tangerine.

In terms of marketing, most of the tangerine produced is for selling to the market. The main market is Dili and Liquica and the main buyers are local traders. The average price offered is $125 per tangerine tree or $3.50 per kilogram. This will provide significant revenue for producers of $1,624,350 annually.

**Cattle** – It is one of the potential agriculture products in Liquica that engage a significant number of households of 4252 with the total number of cattle 10,726 heads (DGE 2015; MAP Liquica 2016). In the past farmers in Liquica raising cattle in a traditional way where cattle left in an open pasture in the morning and fenced in the afternoon. However, due to the continuous assistance and support from MAF and some international agencies such as ACIAR, nowadays farmers raise cattle in an intensive way through fattening system. This resulted Liquica as one of the municipalities that regularly supply cattle to main market in Dili.

Farmers in Liquica raised cattle for a number of reasons and this includes financial necessities for families, cultural and tradition festivals, housing construction, school fees and so on. The main market is Dili and the main buyers are local traders who

operated regularly in this area. In addition, for cattle that raised through fattening system, the price is based on live cattle weight and this is regulated by the government. For example, cattle with live weight 200 – 250 kilograms the price is $2.50 per kilogram and cattle with live weight more than 300 kilograms the price is $2.70 per kilogram. If a cattle weight 300 kilograms means farmers will receive $810 ($2.70 x 300 kg). For farmers who not raise cattle through fattening system the price will depending on the negotiation between cattle owner and trader and this can be vary between $500 – 700 per cattle (300 kg). For bovine meat the price is around $6 – $7 per kilogram.

As per capita consumption of bovine meat nationally is quite low therefore its affect the demand for this type of meat. The demand for bovine meat in Liquica is 88.6 tons per year; while the supply is 1072.6 tons annually. This indicated that there is an oversupply of bovine meat. This can be further exploring to find new market both for domestic and export market.

**Maize** – Most of population in Liquica growing maize. According to DGE (2015) the total number of household involving in maize production is 10,196 households. In addition, the area planted for maize is 1919.53 hectares with the total production of 4408.41 tons and the yield of 2.45 tons per hectare (MAP Liquica 2016).

The main market is Liquica and Ermera; with small volume are selling to Dili market. However, there is a lack buyer, therefore there is only small quantities of the product is sold with the price of 0.40 cents per kilogram. For most part of Liquica, maize usually produced once a year; but in some parts of Liquica such as 'Loes' maize can be produced throughout most of the year. Most of maize produced in Loes is distributed to Dili market as fresh harvest maize. This type of maize has a significant demand in Dili market.

The demand for maize in Liquica is around 6700 tons per year; while the annual supply is only 4408.41. This shows that Liquica need to increase the production of maize to fulfill its demand, as there is a deficit of supply of around 2200 tons per year. One way to increase the production of maize is through the improvement of maize yield and variety or maximizing the use of land area available. Assumed that there is a market available to absorb all the products produced with the price $400 per ton, this will generate revenue of $1,763,200 annually. The details of local potential agriculture products and livestock in Liquica are shown in table below.

Table 12. Description of local potential agriculture products and livestock in Liquica

| Description | Potential local agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | Coffee | Banana | Tangerine | Cattle | Maize |
| Household number | 6703 | Na | Na | 4252 | 10,196 |
| Production (t/year) | Na | 45.9 | 291.7 | 10,726 | 4408.4 |
| Productivity (t/ha) | 0.6 | 9.0 | 11.0 | - | 2.5 |
| Main market | USA , Canada & Australia | Dili | Dili/ Ermera | Dili | Liquica/ Ermera |
| Average price ($/kg) | 0.30/kg | 4/bunch | 150/tree | 7/kg | 0.40/kg |
| Consumption level (kg/cap/yr) | Na | Na | Na | 1.19 | 90 |
| Demand (t/yr) | Na | Na | Na | 88.6 | 6700.8 |
| Current supply (t/yr) | 6703 | 45.9 | 291.7 | 1072.6 | 4408.4 |
| Export (ton) | 10,712.7 (Ripe cherry) | - | - | - | - |

*Source: TLHS 2004; MAP 2014; DGE; MAP; Correia et al. 2015; MAP Liquica 2016; CCT 2019*

### 7.3.7 The potentiality of local agriculture products and livestock in Lautem

Lautem is one of the municipalities in Timor-Leste, which located in the east part of the country. According to DGE (2016) the total population was 65,240 people with gender distribution of 32,062 males and 33,177 females. The total household was 12,050 with the household size of 5.41 (DGE 2015). Administratively the municipality of Lautem composed of 5 sub-districts, 34 villages and 151 sub-villages with the total area of 1,813.11 square kilometers (MAEOT 2016).

Most of the population in Lautem depends on agriculture as a source of income. Total area for agriculture sector is 189,647.65 hectares (DNAH Lautem 2015) with the majority area (134,147.40 ha) destined to forest. The major crops cultivated by most of the population in Lautem are including maize, cassava, coconut, horticulture crops, paddy rice and others. Meanwhile cattle, buffalos, goats, chicken and horse are livestock that generally raised by population in this area. Farmers generally still applied traditional and semi-traditional system in managing their farm with some is moving from subsistence to commercial farming (e.g., raising poultry in an intensive system as a business).

The result of the study revealed that the top five local potential agriculture products and livestock in the municipality of Lautem are **Maize, Coconut, Cattle, Candlenut** and **Cassava**. Most of the stakeholders interviewed describe that these products play an important role in providing food security and also income for most of the population in Lautem. Maize becomes an important diet for population in this area; and coconut plays a pivotal role not only for domestic consumption but it can reach overseas market such as Indonesia.

**Maize** - Lautem is one of the municipalities that is very potential for maize production in Timor-Leste. As maize becomes an important diet for most of the population in Lautem therefore farmers continue to grow this crop by

expanding the area of production and also increase the yield of maize. The total household growing maize in Lautem is 9652 households – around 80 percent of the total household in Lautem (DGE 2015). The potential area for maize production is around 20,000 hectares. From this potential area, there was only 3,799.79 hectares (19%) was planted in 2016 (DNAH Lautem 2016). In addition, the area harvested was 3,048.64 hectares with the total production of 6263.55 tons and the productivity of 2.05 tons per hectare.

From the area planted in 2016, there are 16,200.21 hectares (81%) of that potential a rea still abandoned; the main reason for the abandon of this potential area are including lack of market opportunities, lack of labor and lack of capital. If Lautem can maximize the potential area by 50 per cent only (yield 2.05 t/ha) it can produce around 20,500 tons of maize per year; furthermore, if the yield can be increase by 3.00 tons per hectare, the total production will rise up to around 30,000 tons per year.

With the per capita consumption of maize of 90 kilograms per year (TLHS 2004; MAF & IMF 2011) it means Lautem will need 5871.60 tons of maize per year. From the current production of maize of 6263.55 tons, it indicated that there is a surplus of production of 391.95 tons per year.

Most of maize produced in Lautem (80%) is for home consumption and the rest is for selling to the market. In fact, maize producers in Lautem want to sell more their produce to the market but the volume purchased by traders/buyers is very limited due to the lack of market for this product. The main market is Lospalos and Baucau with some small quantities distributed to Dili market. The average price for maize in Lautem is US$87.5 per drum (1 drum = 200 kg of dry maize) or 0.44 cents per kilogram.

In addition, assumed that 20 percent (1,252.71 tons) of maize is distributed to the market it means it can generate an income of US$551,192.4 per year (average of US$57.1/household). Thus, if 60 percent of total current production can be selling to the market with the average price as mentioned, it means producers will receive revenue of US$1,377,891 (US$142.8/household). This is clear that market availability is an important factor for generating household income in particular in rural areas. Furthermore, if the productivity of maize can be improving this can further contribute to the rising in income for maize producers in that area.

**Coconut -** Coconut is growing well in Lautem. This can be seen through the area that is potential of about 10,000 hectares. From this, around 2,400 hectares (24% of the potential area) was cultivated. The total production in 2016 was 336.59 tons with the yield of 0.24 ton per hectare (DNAH Lautem 2016). In addition, it is around 8000 households (66% of the total household) are involving in the production of this crop (DGE 2015). In Lautem, coconut can be value adding into a number of products. These products include Virgin Coconut Oil (VCO), Copra, and Soap. This kind of

activities continues to develop to a more specific quality product to fulfill the demand of the market both in Timor-Leste and overseas market. A discussion with one of the coordinator of small VCO industry (Ms Mafalda da Costa) in the village of Souro known as 'Homemade Natural Cold Pressed Coconut Oil" revealed that this small business industry can process about 900 coconuts per day, and from this it produces around 90 litters of VCO a day (10 coconut = 1 litter VCO). If the production of VCO is sustainable it needs 32,850 coconuts per year. This will produce around 3,285 litters VCO annually. In terms of marketing, so far VCO from Lautem is marketed through domestic market (e.g., Lospalos and Dili market) and exported to Australia. The price for one litter VCO in domestic market is US$9.50 and for exports US$17 per litter. Based on the total production of VCO and the price mentioned for domestic market, this can generate revenue of US$31,207.5/year. For the export market it will generate an income of US$55,845 annually.

Despite the VCO small business enterprise that already established in Lautem, people are also organize themselves into groups to produce VCO. According to MAP (2015) there were six groups of producers that regularly produce VCO in Lautem for selling to domestic market. The average selling price is US$3.00 per liter. In 2015 these groups produce 460 litters. This small business enterprise contributes significantly to the economy of population in Lautem in particular coconut producers.


Copra

While for copra it exported to Indonesian market through Atambua-NTT. The average buying price of copra from producers is 0.15 cents and the selling price is 0.27 cents per kilogram. Based on the discussion with coconut producers it revealed that the price of copra is very low and therefore it affects their motivation to produce more copra for export. Thus, producers are also selling their coconut direct to the local market with the price of one dollar for 4-5 coconuts.

For the supply chain of VCO and Copra it can be described as follow. For VCO, producer's normally selling their coconut to VCO processing center than the center will process all the coconuts (e.g., grading, cleaning, heating, and pressing). Than it goes to packing and labeling before finally distributed to the market. The activities starting from cleanup the coconut until labeling all is done by women's. For Copra, producers normally distribute their copra to the trader in Lautem, then the trader will dry the product for certain days – than packing, weighted, and transported to the wholesaler in Dili before it further distributed to Atambua, NTT Indonesia. The detail of the supply chain for VCO and Copra can be seen in Figure below.

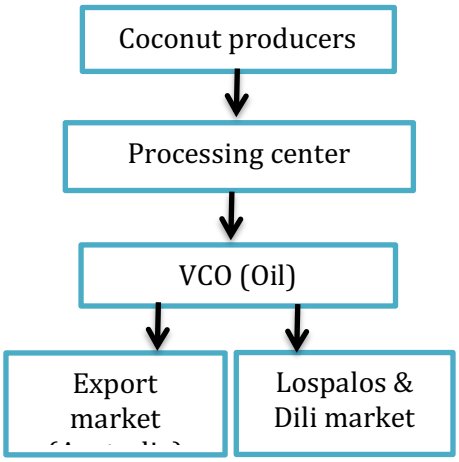



*Figure 15. Coconut Oil supply chain*

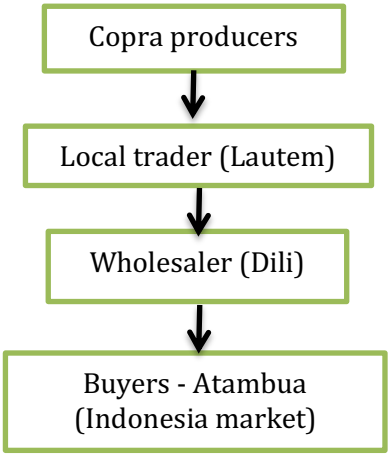
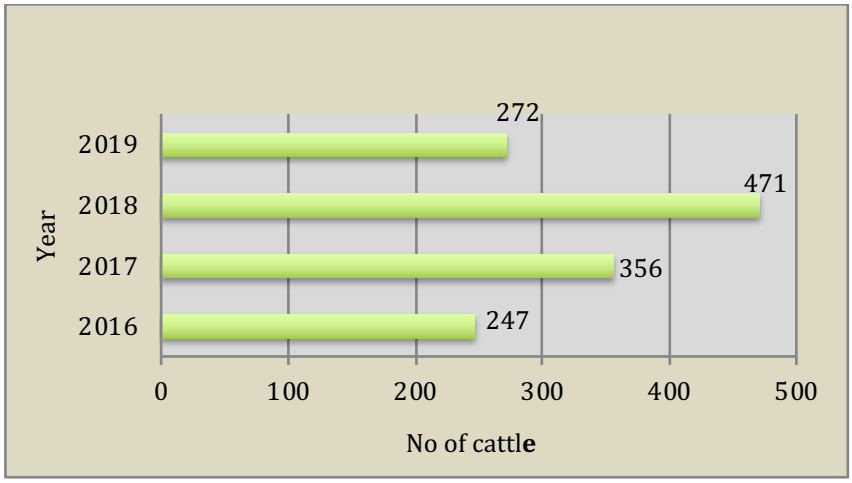



*Figure 16. Copra supply chain*

**Cattle -** The municipality of Lautem has an extensive area of natural pasture with a total area of 19,879.50 hectares (DNAH Lautem 2015). Because of this, large animals such as Cattle (include buffalos and horse) are growing well in this area. General Directorate of Statistic (2015) reveal that the total household engages in raising cattle was 4113 (34% of the total household) with the total number of cattle raised of 16,114 heads (Servico Municipal de Agricultura Lautem 2019). Most cattle raise in an open pasture (traditional system) – cattle owners generally bring their cattle's to the natural pasture in the morning and fenced it in the afternoon. So f ar there is no intensive way of raising cattle (e.g. fattening system) in Lautem. The main buyers are traders who regularly purchase cattle in Lautem and distributed to Dili market. There are a small number of cattle selling in local market to fulfill consumer demand for beef. Data from transit station established by Ministry ofAgriculture and Fisheries shows that the total of cattle distributed to Dili market from 2016 to 2019 reach 1346 heads – average 337 heads per year (Servico Municipal de Agricultura Lautem 2019). The detail of cattle delivered to Dili market is shown in Figure 17.

In terms of price, it ranges from US$150 – US$1500 per head; and this depending on the demand of the market, physical appearance, timing of selling and the customer necessity (e.g., tradition/culture, children schools and so on). The average price in Lautem is US$850 per head and the average price for beef is US$7.00 per kilogram. In addition, the average owned of cattle per household is four cattle's. With the average price as mentioned and assumed that in one year they can only sell two bulls it can generate an income of US$1,700 per household. This contributed significantly to economy of rural household in Lautem.




*Source: Servico Municipal de Agricultura Lautem 2019*

Figure 17. Number o

The national consumption level annually for bovine meat is 1.19 kilogram per capita per year (Varela 2014). This consumption level is lower compared to Indonesia of 2.6 kilogram and an average of least developed countries of 4.8 kilograms (Scott et al. 2016). The income per capita of most of the population in this country contributed significantly to the low consumption level of bovine meat. Therefore, consumer cannot afford to buy expensive product and they prefer to purchase other meat products that is cheaper (e.g., chicken). The national Statistic Directorate (2011) revealed that the mean per capita income per month in Timor-Leste is quite lower of $62; which for urban areas $93 and rural areas $50.

With the consumption level of bovine meat of 1.19 kilogram per capita per year, it means the demand of bovine meat for Lautem is 77.64 tons (776 heads) per year. Meanwhile, based on the total number of cattle in Lautem of 16,114 heads or equivalent to 1611.4 tons of bovine meat (100 kg carcass weight per cattle), this indicated that Lautem is more than enough to supply bovine meat to its population. Based on the demand and supply of bovine meat in Lautem, it shows that there is an oversupply of bovine meat of 1,533.8 tons (15,338 heads) per year. The oversupply of bovine meat can be distributed to Dili market; as the demand for beef in Dili is quite high around 800 tons per year (Scott et al. 2016). This high demand resulted from the annual population growth rate nationally that is quite high of 2.41% and rising of the income of the population in particular Dili. This will provide an opportunity for cattle producers in Lautem to supply cattle to Dili market. In addition, if considered that all cattle's (bovine meat) are sold with the price of $7.00 per kilogram it will generate an income of US$11,279,800 per year (US$2,742.5/household/year).

**Candlenut -** Candlenut is a plantation crops that broadly grown across Timor-Leste including Lautem. It is one of the local potential products in this municipality. This plant can grow well in a variety of conditions including tolerates poor

soils and rocky slopes, tolerant to drought and resistant to disease. The total potential area for candlenut is 3081 hectares, and from this it is only 591 hectares was planted (MAP Lautem 2015). From the total area planted, there is around 300 hectares (10% of national productive area) considered as 'productive' (National Directorate of Coffee & Industrial Crops 2015). The annual production of candlenut in 2015 was 153.25 tons with the yield of 0.5 tons per hectare (DNAH Lautem 2016). This crop has the potential to increase the income of rural population in particular rural women and their household in this area, as they would benefit from managing, producing and marketing of candlenut product.

The main buyers for candlenut in Lautem are local traders from Baucau and also Lautem. In the past there were around 10 local traders, which purchase candlenut from producers and sell it to wholesalers in Dili. Nowadays, because of the low demand from Indonesia buyers resulted from the depreciation of Indonesian 'Rupiah' to US dollar therefore there is only three to five local traders that engage in buying and selling the product in Lautem. The reduction of the number of buyers affects the quantity of the product purchased and the price offer to producers. For example, in the past the average price offered to producers for one-kilogram candlenut with 'kernel' was 0.30 cents and 'cracked kernel' (nut) 0.50 cents per kilogram (MAFF and University of Hawaii 2006).

In addition, the current price offered to producers in Lautem is 0.15 cents per kilogram for candlenut with kernel and 0.17 cents for cracked kernels. Based on the discussions with producers it shows that as a result of the lower price offered most producers in Lautem only sell candlenut with kernel. From trader perspective it revealed the average price offered by wholesaler in Dili is quite lower and this further resulted to the price provided to producers. For example, the selling price for one kilogram of candlenut with kernel is 0.27 cents; while for cracked kernel is 0.75 cents per kilogram. As a result of low price, most producers can only sell candlenut with kernel. The main reason is that the value adds from candlenut kernel to crack kernel (nut) is not followed by the premium price offered.

Candlenut is mostly produced for export. Total export of candlenut from 2005 – 2010 was 4,478 tons (Ministry of Commerce, Tourism & Industry 2010). However, as the prices become too low, farmers stop harvesting and divert labor time to other activities. The main market channel for candlenut is as a food ingredient in Indonesia, whereby candlenut kernel is exported overland to Atambua and further enters the Indonesian supply chain. Local traders purchase candlenut (kernel) from producers and deliver to wholesaler in Dili. Wholesaler will process all the products (kernel and nuts) – such as packing, weighting and transporting to Atambua. The detail of supply chain for candlenut in Lautem is shown in Figure 18.

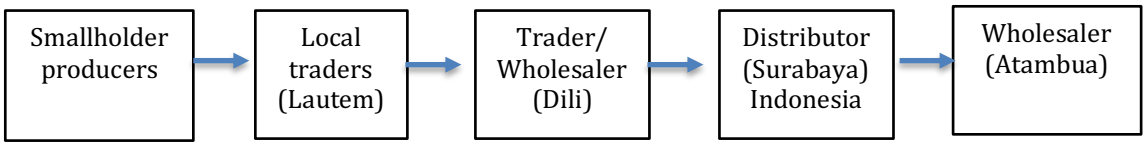



Figure 18. Candlenut supply chain Lautem

According to Krisnawati et al. (2011), in one hectare can be planted 250 trees of candlenut and one tree can be producing around 80-kilogram candlenut per year. Based on the total productive candlenut area in Lautem of 300 hectares means it can produce 6000 tons of candlenut per year. If assume that all of the quantities as mentioned sold with the current price of candlenut kernel of 0.15 per kilogram, this can generate revenue of US$900,000 annually.

Candlenut provides significant opportunities as an income generator for poor, rural populations in Timor-Leste. However, to improve the income of rural population it is important to value adding the products to high quality for niche market instead competing in mass markets based on volume and price. For the least, Timor-Leste is largely at a competitive disadvantage for exporting basic candlenut products to the global market (USAID 2015), which is due to the lack of market development, poor infrastructure and small-scale, subsistence-oriented production.

Table 13. Total export of Candlenut (2005-2010)

| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Total Export (MT) | 1009 | 1070 | 344 | 1094 | 459 | 502 |

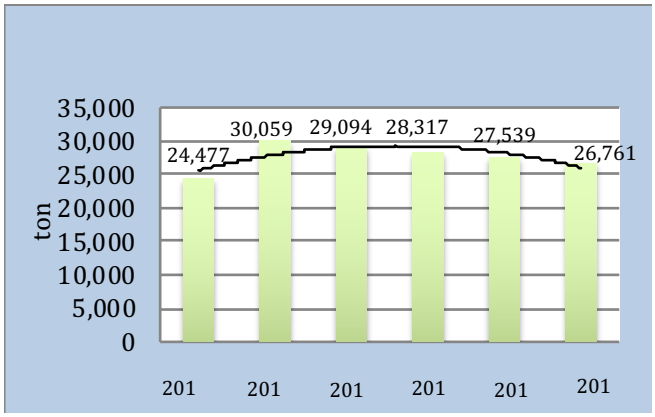
*Source: Ministry of Commerce, Tourism and Industry, 2010*

**Cassava -** It is one of the local potential products in Lautem that engages a significant number of household (7863 household) in producing the product. Cassava also becomes an important subsistence crop as most rural population continues to grow as food security for their families. The total potential area for cassava is 2020.2 hectares and the area planted in 2017 was 538.3 hectares (Servico Municipal de Agricultura Lautem 2017).

Cassava produced in Lautem generally for own consumption with small volume delivers to the local market. Cassava that distributed to the market mostly is fresh cassava and the price is 0.05 cents per kilogram. Because of the price paid that is very low therefore this product is not attractive to motivate producers to produce for the market.

Cooperativa Café Timor (CCT) is one of the private sectors that not only concentrate in coffee but also diversify its business into other commodities including cassava. Lautem is one of the CCT branches, which prioritize certain commodities to be developing such as Robusta coffee,

Pepper, Moringa, Clove, Cassava and Manggo. The consideration for developing and producing cassava in Lautem shows that this municipality in terms agronomic condition is suitable and also the availability of land and climate is quite favorable. According to Mr Guimaraens (CCT coordinator in Lautem) cassava grown by CCT is a new variety that develops to fulfill the demand of raw materials for producing beer in Dili. This new variety is already distributed to producers in Lautem. Producers that organize into group will produce cassava and sell it to CCT with the price as mentioned. Despite this, CCT also has its own land for growing cassava. According to FAO.Stat (2018), the production of cassava in Timor-Leste from 2012 – 2017 was fluctuated. For example, in 2012 the production was 24,477 tons, and in 2013 in increase to 30,059 tons, then in 2017 it decreases to 26,761 tons per year. The detail is shown in Figure below.




*Source: FAO.Stat 2018*

Figure 19. Production of Cassava in Timor-Leste (2012-2017)

As one of the raw materials for producing Beer, this offer an opportunity for producers in Lautem to produce more cassava so that it can fulfill what is demanding by the market and the sustainability of the produce can be maintained.

Table 14. Description of local potential agriculture products and livestock in Lautem

| **Description** | **Top 5 local potential agriculture products and livestock** | | | | |
|---|---|---|---|---|---|
| | **Maize** | **Coconut** | **Cattle** | **Candlenut** | **Cassava** |
| Household number | 9652 | 8092 | 4113 | Na | 7863 |
| Production (t/year) | 6263.55 | 336.59 | 16,114 head | 153.25 | 1883 |
| Productivity (t/ha) | 2.05 | 0.24 | 4 cattle's/hh | 0.5 | Na |
| Main market | Lautem/ Baucau/Dili | Dili/ Ind./ Australia | Dili | Indonesia | Lautem |
| Average price ($/kg) | 0.44 | 0.20/coconut | 7.00 (850/head) | 0.15(Kernel) | 0.05 |
| Consumption level (kg/cap/yr) | 90 | Na | 1.19 | Na | Na |
| Demand (t/yr) | 5871.6 | Na | 77.64 | Na | Na |
| Current supply (t/yr) | 6263.55 | 336.59 | 1611.4 | 153.25 | |
| Export (t/year) | Na | Na | Na | 746.33 | Na |

*Source: TLHS 2004; MAF 2010; MAF; NSD and UNFPA; RDTL; IMF 2011; MAP 2012; Varela 2014; DNAHE-MAF 2015; DGE 2015; Scott et al 2016; MAP Lautem 2019*

### 7.3.8 Potentiality of local potential agriculture products and livestock in Viqueque

The municipality of Viqueque situated in the south part of the country. Administratively it constituted of 5 Sub-Districts and 36 Villages with the total area of 1,880.39 square kilometers (MAEOT 2017). The total population is 77,877 with total household of 15,297 and the household size of 5.82 (DGE 2015;).

Most of the population in Viqueque depends on agriculture as a source of food security and income. The main crops grown include paddy rice, maize, cassava, coconut, banana, horticulture crops, soybean, green bean and others. For livestock, cattle, buffalos, pig, chicken and horse are animals that generally raised by most of the population in Viqueque. Most farmers still practicing traditional ways in managing their farm and this resulted in a low production and productivity of the crops planted.

The study found that **Paddy rice, Maize, Cattle, Coconut** and **Candlenut** are the top 5 local agriculture products and livestock that is potential in Viqueque. Stakeholders interviewed pointed out these products offer significant jobs to rural communities, providing incomes, and in terms of market, traders and wholesalers regularly engage in buying and selling of these products to the market. The majority of the population in Viqueque relies on these products for cash and also basic food necessities.

**Paddy rice -** Viqueque is one of the municipalities known as potential area for paddy rice production in Timor-Leste. The center for paddy rice production in Viqueque is in the Sub-District of Uatulari, Viqueque Villa and Uatucarbau. The total household engage in the production of the product is 9,115 or around 60 percent of the total household (DGE 2015) with the total potential area of 9,793 hectares. From this, there are only 3,987.92 hectares (41%) was planted with the total production of 19,107.81 tons and the yield of 4.79 tons per hectare (MAP Municipio Viqueque 2019). This yield is higher than national average, which is only around 2.8 tons per hectare. Indeed the area planted, total production and the yield of paddy rice in 2019 were increase compared to previous year. In 2018, the cultivation area was 2,910.88 hectares with the total production of 10,543.52 and the yield of 3.62 tons per hectare (MAP Municipio Viqueque 2018). This means that from 2018 to 2019 the cultivated area increased by 55.2 percent and the yield increase by 0,24 percent. The details of the production and yield of paddy rice from 2017-2019 are shown in table below.

Table 15. Area planted, area harvested, total production and yield of paddy rice (2017-2019)

| Year | Potential area (ha) | Area Planted (ha) | Area harvested (ha) | Total production (t) | Yield (t/ha) |
|---|---|---|---|---|---|
| 2017 | 9,793 | 1490.89 | Na | 5,640.03 | 3.60 |
| 2018 | | 2,910.88 | 2,910.88 | 10,543.52 | 3.62 |
| 2019 | | 3,987.92 | 3,987.92 | 19,107.81 | 4.79 |

*Source: MAP Municipio Viqueque 2019*

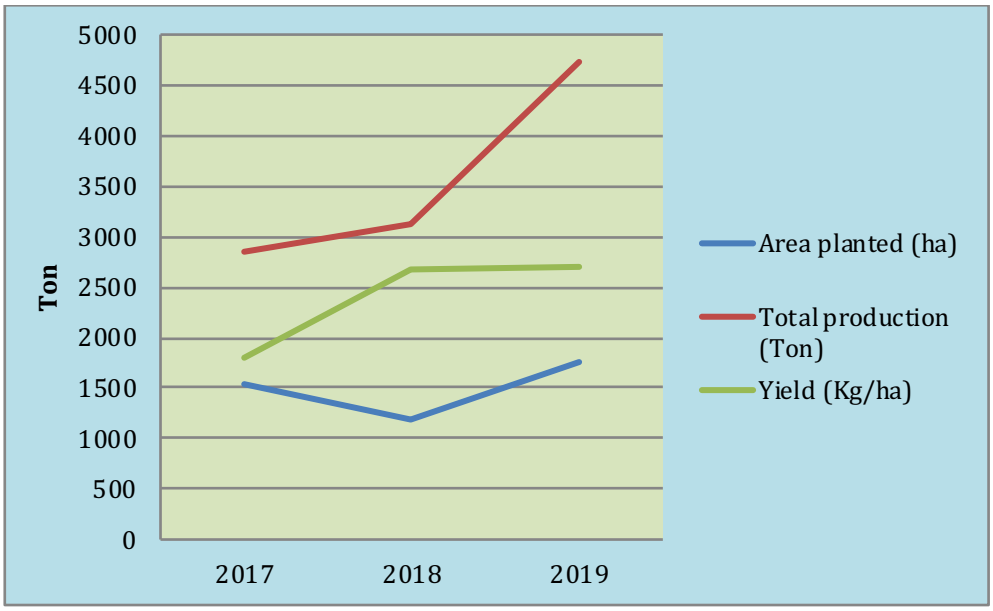
The potential area of paddy rice in particular for Uatulari and Uatucarbau was supported by two big irrigations known as Bebui and Baidubu irrigation scheme. Bebui irrigation is located in Sub-District of Uatulari, which covers 1,100 hectares; while Baidubu irrigation situated in the Sub-District of Uatucarbau with the total area covered 800 hectares.

In terms of market, most stakeholders interviewed pointed out there are lack of buyer and market for this product. Because of this most of the produce destined for own consumption with very small quantity sell to local market. In the past ACELDA is one of the private firms that purchase paddy rice from these areas and the price offered was of 0.40 cents per kilogram. Nowadays there are no more trading activities done by ACELDA in Viqueque. The main reason is lack of infrastructure facilities such as road - as this affect the cost of transportation on the delivering of the product to warehouse in Baucau. In addition, based on a discussion with MCI vocal point in Viqueque revealed that in harvesting time CLN normally came to Viqueque to buy paddy rice with the price as mentioned (0.40/kg). However, the continuity of CLN in purchasing the product annually cannot be guaranteed.

Based on the per capita consumption for rice of 95 kilograms per year (TLHS 2004) it means Viqueque will need rice 7,398.32 tons per year. Meanwhile the current production of paddy rice is 19,107.81 tons or equivalent to 11,464.69 tons of rice (conversion 60% paddy rice to rice). This shows there is an oversupply of rice in Viqueque of around 4000 tons annually. This provides an opportunity for private sector to invest in locally produced rice and in the same time promoting local potential product to the national level. This can further have resulted in the reduction of the importation of rice into the country.

If assumed that 50 percent of paddy rice produced in Viqueque can be delivered and sold in the market with the price of 0.40 cents per kilogram – this can generate an income of US$7,643,123 per year or US$838.52 per household per year. The annual production as mentioned is only produce once a year. If in one-year can be produce twice it means the production will be double and this will further impact on the income receive by rural households. This provides significant revenue for rural households, which depends of paddy rice as a source of income.

**Maize -** Another local potential agriculture product in the municipality of Viqueque is Maize. The majority of the households (74.15%) in this area produce maize every year. This can be seen through the potential area for maize, which is 13,250 hectares. From this, only 13.26 percent (1757.34 ha) of the land was cultivated. The current production is 4,729.60 tons with the productivity of 2.70 tons per hectare (MAP Municipio Viqueque 2019). The details of the area planted and production of maize in Viqueque from 2017 – 2019 is shown in Figure below.




*Source: MAP Municipio Viqueque 2019*

Figure 20. Area planted and production of maize in Viqueque (2017-2019**)**

Figure 6 shows that the production of maize is always increasing. For example, from 2017 to 2018 it rose by 9.53 percent and 2018 to 2019 by 51.52 percent. In addition, even though the area planted decrease in 2018 by 339.3 hectares however, in the same year the yield increases from 1.80 ton up to 2.67 tons per hectare. This resulted in an increase in the total production of maize from around 2800 to 3100 tons.

Based on the consumption level of maize per capita of 90 Kilograms per year, it means the demand of maize in Viqueque will be 7,008.93 tons annually. In addition, from the production level of maize of 4,729.6 tons per year, this indicated that the current production cannot fulfill the demand of maize in Viqueque. This shows there is a deficit of around 2,200 tons of maize annually. To fulfill the demand of maize in this municipality, it is important to maximize the potential area that exists (yield maintained 2.7 tons/ha). If the area planted can be increase by 20 percent (from the potential area) it will produce around 7100 tons of maize per year – and this can solve the deficit of maize faced.

Most of the maize produced is for own consumption with the rest distributed to the market. There is a lack of market opportunities for this product and therefore producers only produce enough for their own consumption. The main market is local market in Viqueque with small volume distributed to Baucau and Dili market. The main buyers are local traders and consumers in Viqueque, which purchase maize for own consumption and also trading to Baucau and Dili market. The average price of maize is 0.40 cents per kilogram with the minimum price of 0.20 and maximum 0.60 cents per kilogram.

If assumed that 80 per cent of the products produced in Viqueque are sold in the market with the price as mentioned, this will generate an income to producers of US$1,513,472 annually or US$133.43 per household per year. Indeed, the income of producers can only be increase by rising the productivity or open-up more potential land for maize cultivation.

**Cattle** - The third local potential agriculture products and livestock in Viqueque is Cattle According to the manager of one of the famous butcher in Dili known as 'Talho Moris' reveal that Viqueque is one of the area that regularly supply cattle to Dili market. In addition, a study done by Scott et al. (2016) also describe that at cattle numbers increase in the more extensive grasslands of the east which includes Viqueque, Lautem and Baucau. The total household raise cattle are 10,547 or 68.9 percent of the total household in Viqueque; and the total number of cattle is 21,243 heads (MAP Viqueque 2017). This indicated the average cattle owned are around two cattle per household. The detail of the number of cattle per sub-district is shown in Table below.

Table 16. Number of cattle per sub-district in Viqueque

| Sub-District | Number of cattle (head) |
|---|---|
| Viqueque Villa | 8,790 |
| Uatulari | 4,070 |
| Ossu | 3,137 |
| Uatucarbau | 2,801 |
| Lacluta | 2,445 |
| Total | **21,243** |

*Source: MAP Municipio Viqueque 2017*

The system of raising cattle is still based on the traditional system where cattle are freed in the morning for finding fed in an open pasture and fenced in the afternoon. Cattle can be penned at night, seasonally, or in some cases not at all. In some remote areas in Viqueque, cattle are raised in larger household herds in more extensive systems for long indefinite periods with low turnoff rates. Indeed, cattle in Viqueque mostly raised in low input – low output systems. With low inputs (feed, labor, capital),

outputs are also low (beef production). These production systems are not necessarily inefficient per se, especially as costs are low. However, cattle production systems in Viqueque can be seen as inefficient insofar as the existing resources are under-utilized. ACIAR through its project started to introduce an intensive way of raising cattle such as 'fattening system' in some of the areas in Viqueque. This is an opportunity where producers can maximize the resource owned and intensively manage their cattle's.

The main market is Dili market with small number of cattle's sold in local market. The main buyers are traders that regularly purchase cattle from the villages and distributed to Dili in a weekly basis. Cattle mostly are traded through spot markets, and slaughter men and traders have extensive purchase networks, and can buy direct from farmers, or through local level collectors and spotters. Most end-buyers (slaughter men) in Viqueque require only small lots (e.g. to slaughter 2-4 head per week), and traders try to aggregate a full truck (6-8 head depending on size) to reduce transport costs. In addition, there is also a large and vibrant trade in cattle, buffaloes and other animals in Viqueque for ceremonies such as funerals, weddings, graduations and others. In terms of price for cattle, it ranges from US$150 – US$700 per head; and the average price is $445 per head. For bovine meat it cost US$6.00 per kilogram. Assumed that each household will sell only one cattle per year with the price as mentioned, this will provide and income of US$4,693,415 per year.

Figure 21. Cattle

According to DNS and World Bank (2018) average annual per capita bovine meat consumption in Timor-Leste is 1.19kg. This consumption levels are significantly lower than the average for least developed countries of 4.8 kilogram, lower than Indonesia of 2.5 kilograms and indeed lower than all Asian countries (Scott et al. 2016). The low level of consumption is clearly constrained by low incomes, with mean per capita incomes per month of $62; in urban $93, and rural areas $50 (DNS, 2011). Based on that consumption level as mentioned, it means Viqueque will need 92.67 tons of bovine meat or 927 heads per year; while from the supply side, it can supply around 2,100 tons of bovine meat annually. This indicated that there is an oversupply of bovine meat of 2,007.33 tons or equivalent to 20,073 heads annually. This clearly shows that Viqueque will be able to supply Dili market in a sustainable manner

throughout the year. This provides an opportunity for local private sector to engage more in this sector in Viqueque. Scott et al. (2016) in their study revealed that beef consumption could be expected to increase with sustained income growth (a function of developments in the oil sector, political stability, public servant wages and pensions). Another driver of consumption is population growth of 2.41 percent per year, which if continued, will double the population by 2039. Because of urban migration, population growth in Dili will be 4.8 percent, where net per capita supply of bovine meat is estimated at 3.94 kilograms (three times higher than the national average).

**Coconut –** It is one of the industrial crops that grown well in Viqueque. Coconut plays an important role in terms of income for most of rural household in Viqueque as it involves around 10,500 households. The sub-district that is potential for coconut includes Viqueque Villa, Uatulari and Ossu. Since Indonesian time until now coconut usually transforms into 'Copra' and exported to Indonesia. The Potential area for coconut in this municipality is 10,105.15 hectares; however, the area cultivated is only 4,020.25 hectares (39.8%) with the total production of 3,550 tons (MAP Municipio Viqueque 2017).

In Viqueque coconut can be selling as primary product (coconut), or as secondary products (e.g., copra, VCO, oil). For domestic consumption most of the populations generally purchase it as a coconut, oil for cooking and also VCO. For copra it is an export product, which exported to Indonesia. In addition, coconut and oil mostly sell in local market, while some small quantities of oil and VCO also distributed to Dili market. The main buyers for copra are local traders.

The study shows that local traders purchase copra from producers with the price range between 0.15 – 0.17 cents per kilogram depending on the quality of the product, and sell it to the Wholesalers in Dili between 0.22 – 0.25 cent per kilogram. Meanwhile the price for one coconut is 0.10 cents. An interview with local traders revealed that the average distribution of copra to Dili market is twice a month with the total quantity distributed started from 3.2 up to 60 tons per month. The percentage of coconut and copra is 4:1 (4 coconuts for 1 kg of copra). This means that one tons of copra will needs around 4000 coconuts.

Even though the price of coconut and copra is quite low in Viqueque however, it's provided significant revenue for producers and local traders. With the average quantity of copra distributed to Dili of 31.6 tons per month, this will provide an income to local traders of US$7,584 per month (US$91,008 annually). For producers it will offer a monthly income of US$5,056 (US$60,672/year). If the price or the quantity deliver of copra increase, this will provide more income both for producers and traders in Viqueque.

**Candlenut -** It is a cash crop that can be found at altitudes ranging from sea level up to 700 meters and can survive in areas with rainfall ranging from 700 mm up to 2,000 mm (DAI 2005). The topography in Viqueque is feasible for candlenut to grow and it offers significant revenue to producers. According to MAP Municipio Viqueque (2017) the potential area for candlenut is 3,081 hectares; from these 891 hectares are planted with only 480 hectares is productive. There is a lack of data about production in Viqueque but in Timor-Leste the productivity per hectare range from 0.5 to 1.0 tons per hectare (DAI 2005); and this is ten times lower than productivity in West-Timor, Indonesia. If candlenut can be managed in an intensive way, one candlenut tree can yield around 200 kilograms (cracked kernel) per year. With the planting distance of 10 x 10 meters, it means one hectare can be planted 100 – 150 candlenut trees; this will produce 15 – 16 tons of candlenut nuts (Dirjen Perkebunan 2006). This indicated that there is still an opportunity to increase production of candlenut in the year to come.

The main market for candlenut is Indonesian market. Most producers in Viqueque sell only cracked kernel (nuts) to local traders with current average price of 0.75 cents per kilogram. The selling price to the wholesaler in Dili is ranging from US$1.00 – US$1.50 per kilogram. A discussion with Mr Zacaria Pinto (candlenut trader) reveals that in one-month they can only deliver candlenut one time to Dili with the quantity of 255 kilograms (8-9 sacks @30 kg/sack). Exports candlenut to Indonesia market is governed by the price of the nut in that market. So if prices in the West-Timor market are a little bit high, this will dictate a buying price of the nuts in Timor-Leste. In addition, the chain for candlenut in Viqueque is as follows. Producers deliver their product to local traders, then they will process it (e.g., drying, packing, weighting) and transporting to wholesaler in Dili; and then it will further distribute to Atambua NTT, Indonesia.

Based on the current price and the quantity distributed per month, it will generate an income per month of US$318.75 (US$3825/year) for traders and US$191.25 (US$2,295/year) for producers. There is an opportunity to increase the income for both producers and traders. This can be done through the increase of productivity and also improve the quality of the nuts. To increase productivity and quality product, the involvement of public and private sector is needed to support this sector as this product is destined to export market, which can generate revenue to the country. According to USAID (2015) there is continuing high demand for candlenut in Indonesia as a food ingredient. This offers an opportunity for local businesses in meeting this demand through the increase in planting of candlenut throughout the country.

Table 17. Description of local potential agriculture products and livestock in Viqueque

| Description | Top 5 local potential agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | **Paddy Rice** | **Maize** | **Cattle** | **Coconut** | **Candlenut** |
| Household number | 9115 | 11,343 | 10,547 | 10,500 | Na |
| Production (t/year) | 19,107.81 | 4,729.60 | 21,243 head | 3550 | Na |
| Productivity (t/ha) | 4.79 | 2.70 | 2 head/hh | Na | 0.75 |
| Main market | Viqueque | Viqueque & Baucau | Dili & Viqueque | Indonesia (copra) | Indonesia |
| Average price ($/kg) | 0.40 | 0.40 | 445 | 0.10/0.16 | 0.75 |
| Consumption level (kg/cap/yr) | 95 (rice) | 90 | 1.19 | Na | Na |
| Demand (t/yr) | 7,398.32 | 7008.93 | 92.67 | Na | Na |
| Current supply (t/yr) | 11,464.69 | 4,729.60 | 2100 | 3550 | Na |
| Export (t/year) | Na | Na | Na | Na | Na |

*Source: TLHS 2004; DNS & World Bank 2008; Varela 2014; DGE 2015; Scott et al. 2016; MAP Municipio Viqueque 2017 & 2019 (conversion paddy rice to rice is 60%)*

### 7.3.9 Potentiality of local potential agriculture products and livestock in Manatuto

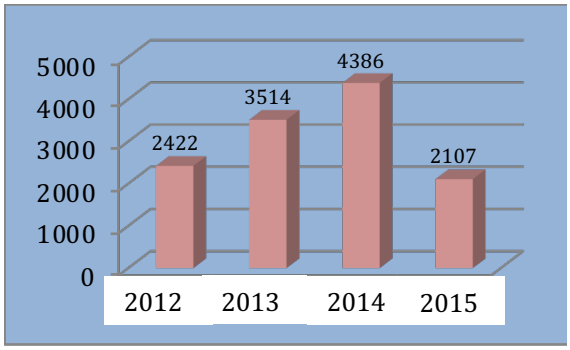
Manatuto is the only municipality that extends from the north coast to the south coast, encompassing all agro-ecological zones in Timor-Leste. Administratively Manatuto composed of six Sub-Districts, 31 Villages and 105 Sub-Villages with the total area of 1,785.9 square kilometers (MAEOT 2016). The total population is 47,806 with the total household of 7467 and the household size of 5.97 (Servico Estatistica Municipio Manatuto 2016).

The majority of the population in this area depends on agriculture as a source of livelihood and income. In the northern part of Manatuto, paddy rice is extensively planted in rehabilitated irrigation schemes while in the central uplands subsistence agriculture is practiced based on maize inter-cropped with cassava, beans, pumpkins and other crops; thus paddy rice is also planted on a small scale in rain-fed area of the sub-district of Natarbora, closer to the south coast. At higher altitudes coffee is also cultivated to a limited extent. Main livestock are sheep, chicken, cattle, buffalo, pig and others.

The result of the study reveals that the top 5 local agriculture products and livestock that are potential in Manatuto are **Maize, Banana, Cattle, Paddy rice** and **Tangerine**. These products are potential because it contributed to the livelihood and income of most of the household in Manatuto. All these products are also grown well in this municipality and for some of the products regularly distributed to main market in Dili (e.g., banana, cattle and rambutan).

**Maize –** As one of the potential product in Manatuto, it's engaging a significant number of household (4607 household) to produce. The area potential for maize is 19,896 hectares. From this there is only 1,118.9 hectares (5.62%) is cultivated with

the production of 2,107.4 tons per year (MAP Municipio Manatuto 2015) and the productivity of 1.88 tons per hectare; this is lower than average national of 2.10 tons per hectare (DNAH 2015). In addition, the production of maize in the last four years (2012-2015) is fluctuated. From 2012 the production was 2422 tons and in 2014 it jumps up to 4386 tons and in 2015 it down to 2167 tons (MAP 2015). The details of the production of maize in Manatuto are shown in Figure below.




*Source: MAP 2015*

Figure 22. Production of maize (2012-2015)

Figure 8 show that the average production of maize per household per year is only 0.84 tons. Indeed, the varieties of maize planted by most of producers are 'Sele' and 'Bisma' which has shown high productivity of 5.0 and 8.7 ton per hectare respectively (Sirappa and Razak 2010).

There is lack of marketing opportunity for this product, and therefore producers only produce enough maize for family consumption. Maize mainly sells through local markets; and buyers generally are consumers and some local traders. Producers sell dry maize with the price range from 0.40 – 0.50 cents per kilogram. In addition, there is not much value added activities for this product.

Based on the per capita consumption of maize, the municipality of Manatuto will need around 4,300 tons of maize per year. Meanwhile from the supply side, it can only supply around 2,100 tons annually. This indicated that the current production couldn't fulfill the demand of maize for the population in Manatuto. There is a deficit of around 2,200 tons' maize per year.

**Banana –** it is one of the types of tropical fruit that growing well in the southern part of Manatuto (Natarbora) and has the potential to develop in an intensive way in the future. The total area planted is 37.3 hectares, with the production of 1,119 tons per year (DNAH 2008) and the productivity of 30 tons per hectare. Most people in Natarbora involve in the production of banana and the main type of banana produced is Saba banana ('Hudi Fatuk').

The main market for this product is Dili market with small quantities selling through local markets. Traders came regularly in a weekly basis to purchase banana and distributed to Dili. The main buyers are traders from Baucau and Dili. Most people in

this area generated their income from banana – This reflects that large quantities of products are sold to the market.

Producers in Natarbora normally sell banana to traders in 'big bunch' – an average price for one big bunch of banana is US$3.00 (US$150/ton). One big bunch composed of 15 small bunches; and the weight of one big bunch is about 20 kilograms (50 big bunch = 1000 kg) while for small bunch is about 1.34 kilograms. This means one-kilogram banana will cost about 0.10 cents. In addition, traders sell bananas to retailers with US$5.00 – US$6.00 per one big bunch (US$275/ton). Thus, retailers sell the banana to institutional customers and consumers in small bunch with the price range from $0.75 cents – US$1.00. It means that one big bunch of banana will cost around US$13.00 (US$650/ton). This indicated the demand for banana domestically is quite high as traders hire trucks in a weekly basis to transport banana and other local products to Dili market (transport cost range from US$600 – US$1,000 per trip).

If assume that the production of banana as mentioned (1,119 tons) all is marketed with the price of US$150 per ton – this will generate a revenue for producers of US$167,850 per year; US$307,725 for traders; and US$727,350 for retailers per year. This product offers a significant income for producers and buyers involve in the production and distribution of the product to the market.

**Cattle –** Most stakeholders interviewed pointed out that cattle is one of the livestock that is potential in the municipality of Manatuto. The main reason for this is because the existing domestic market for cattle is good, the demand for bovine meat in Dili market is high, there is a wide area of pasture for grazing in particular in south coast area, and it engages a significant number of households in raising cattle.

The total household involve in raising cattle in Manatuto is 1831 household with the total number of cattle of 9,282 heads; this means an average owned per household is five cattle's (DGE; MAP Municipio Manatuto 2015). In addition, in 2016 the total number of cattle was down to 4,828 heads (47.98%). There is no clear reason why the numbers of cattle in that year decrease drastically.

In addition, there is two ways of raising cattle in this area. First, cattle are grazing in an open pasture in the morning and penned it in the afternoon. Second, cattle are raise through a fattening system (intensive) – where cattle are feeding in a regular basis (morning-night) in the cage. The later mostly applied by producers reside in Natarbora.

The main market is Dili; and the main buyers are local traders who regularly purchase and sell cattle to the main market. The price of bovine meat in Manatuto is US$6.00 per kilogram. Meanwhile the price of cattle is varying; for producer with traditional system, cattle sell directly to local traders and the price is based on the negotiation, the physical appearance of cattle and others. For this the price is range from US$250 up to US$800 per cattle. For producers using fattening system, the price is based on the weight of the animal. For cattle weight less than 200 kilograms it cost US$2.00 per

kilogram (life cattle) and for cattle weight more than 300 kilograms it cost US$2.75 per kilogram (details see table 8). Indeed, for producers with fattening system, the price is very transparent both for producer and buyers as all depends on the weight of the cattle. The more the weight will increase the revenue received by producers. Producers applying fattening system get assistance from ACIAR project and MAP in a regular basis.

The demand for bovine meat in Manatuto is 56.89 tons per year (based on bovine meat consumption of 1.19 kg/cap/year). Meanwhile the supply of bovine meat per year is 482.8 tons. This shows there is an oversupply of bovine meat of around 425 tons (4250 cattle's) annually. As the demand of bovine meat in Dili that is quite high (Scott et al. 2016), this offer an opportunity for local entrepreneur to more involve in facilitating such business in the year to come. In terms of revenue it is quite promising. Assume that the oversupply of cattle (bovine meat) as mentioned is distributed to Dili market with the price of US$2.70 per kilogram life cattle – this will generate an income of US$3,442,500 per year (assume average weight 300 kg/head) or 1,880.10 per household per year.

Table 17. List of price for live cattle

| Cattle wight (Kg) | Price ($/Kg) |
|---|---|
| < 200 | 2.00 |
| 200 - 249 | 2.50 |
| 250 – 299 | 2.70 |
| > 300 | 2.75 |

**Paddy rice –** The municipality of Manatuto is one of the municipalities that are potential for rice production in Timor-Leste. Because of this potentiality, two permanent irrigation schemes such as Laclo and Buruto irrigation were established. The total number of household engage in the production and marketing of paddy rice is 3,026 household or around 40.5 percent of the total household in Manatuto (DGE 2015). Sub-districts that are potential for paddy rice in are Laleia (Buruto irrigation), Manatuto Villa, Laclo and some dry land areas in Natarbora.

The area potential for paddy rice is 23,650 hectares with the cultivated area of 1,863 hectares in 2015 and 1,661.7 hectares in 2016 (MAP Municipio Manatuto 2016). In addition, the total production was 2,997.10 and 6,288.10 tons per year respectively. In terms of productivity, it was 1.8 tons per hectare in 2015 - and increase up to 3.03 tons per hectare in 2016 (increased by 40.59%). The increase of the productivity mainly is caused by the application of Integrated Crop Management (ICM), use of hybrid variety of paddy rice and irrigation. A report done by JICA (2013) revealed that before the establishment of irrigation scheme the productivity of paddy rice was 1.7 tons per hectare; and after irrigation was ready and implemented the productivity rose up to 3.28 tons per hectare.

With the conversion of paddy rice to rice of 60 percent, it means the total rice production in Manatuto in 2015 was 1,798.26 tons and 2016 was 3,772.86 tons. Based on per capita consumption of rice of 95 kilograms per year in Timor-Leste, Manatuto will need 4,541.57 tons of rice per year. Indeed, the total production as mentioned cannot fulfill the demand of rice for the population in this area. There is a deficit of around 768.71 tons annually.

The main market for rice is Manatuto itself (local market) with small volume distributed to Dili market. There is lack of market opportunities for this product as imported rice dominated local markets and villages with the price below local rice. The main buyers are local consumers and some traders in this area. A discussion with some of paddy rice producers revealed that in the past the Center for National Logistic (CLN) was also bought paddy rice from producers with the price 0.40 cents per kilogram; but now a day there is no such activities done by CLN in Manatuto.

To fulfill the demand of local rice in Manatuto it is important to maximize the potentiality area for paddy rice, as the current cultivated area is only 7.03 percent from the total potential area that exist in Manatuto. In addition, there is an availability of water throughout the year as there is two irrigation schemes established in this area. So, increase the production of paddy rice is viable and therefore private sector intervention is needed to support the sector. Assume that producers can maximize the use of a half (50%) of the potential land or around 11,800 hectares (productivity remain 3.03 tons/ha), it will produce 35,829.75 tons of paddy rice or equivalent to 21,497.85 tons of rice. If a half of this production (paddy rice) is sold to the market with the price as mentioned it will generate an income of US$17,914.88 per year.

Table 19. Demand forecast for rice in the municipality of Manatuto, 2021 – 2025

| Description | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| Population (based census 2015) | 52,809 | 53,918 | 55,050 | 56,206 | 57,386 |
| Demand for rice (ton/year) | 5,016.86 | 5,122.21 | 5,229.75 | 5,339.57 | 5,451.67 |

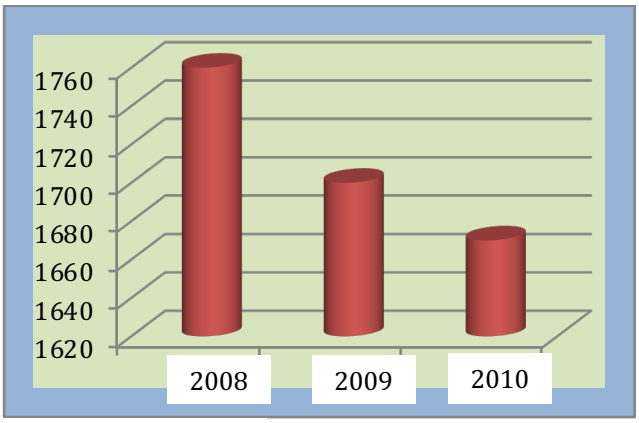
*# Per capita consumption is 95 kg per year; average national population growth rate = 2.1%*

Based on the demand forecast as shown in Table 9, it means that with the population growth rate of 2.1 percent per year, the municipality of Manatuto will need rice around 26,160 tons for the next five years.

**Tangerine –** It is one of the commodity that is potential in the municipality of Manatuto. Tangerine is grown well in areas range from lowland to upland. Areas suitable for tangerine in Manatuto are inluding Laclubar, Soibada and some part of Natarbora.

The total potential area for tangerine in Manatuto is around 19,800 hectares, and from this there is only 8.67 hectares was planted in 2012 and 9.10 hectares in 2013 (DNAH 2014). The total production was 104.04 and 91.00 tons respectively; while the productivity is 11 tons per hectare and this is still low compared to Indonesia of 21

tons per hectare. The production of orange in Timor-Leste from 208-2010 is continuing to decrease from 1760 tons in 2008 down to 1670 tons in 2010 as shown in Figure 23.




*Source: DNAH-MAP*

Figure 23. Production of Tangerine in Timor-Leste

Tangerine produced in Manatuto mostly distributed to Dili market with small volumes sell through local market and the surrounding municipalities such as Manufahi and Viqueque. The main buyers are traders and wholesalers who purchase tangerine in a bulk (based on trees). In terms of price, producers generally sell one tree of tangerine ready for harvest for $100-200/tree (one tree can produce an average of 35 kg of tangerine). This means one kilogram of tangerine can be sold by 0.23 cents per kilogram. According to Badan Penelitian dan Pengembangan Pertanian (2012), one hectare can be planted 500 tangerine trees. With the average price of $150 per tree it can generate an income of $75,000 per year.

Table 20. Description of local potential agriculture products and livestock in Manatuto

| **Description** | **Top 5 local potential agriculture products and livestock** | | | | |
|---|---|---|---|---|---|
| | **Maize** | **Banana** | **Cattle** | **Paddy Rice** | **Tangerine** |
| Household number | 4,607 | Na | 1,831 | 3,026 | Na |
| Production (t/year) | 2,107.40 | 1,119 | 9,282 | 6,288.10 | 91.00 |
| Productivity (t/ha) | 1.88 | 30 | 5 cattle's/hh | 3.03 | 11.00 |
| Main market | Manatuto & Dili | Dili | Dili | Manatuto & Dili | Manatuto |
| Average price ($/kg) | 0.45 | 0.10 | 2.70 | 0.40 | 0.23 |
| Consumption level (kg/cap/yr) | 90 | Na | 1.19 | 95 | 3.60 |
| Demand (t/yr) | 4,300 | Na | 56.89 | 4,541.57 (rice) | 167.83 |
| Current supply (t/yr) | 2,100 | 1,119 | 482.80 | 3,772.86 | 91.00 |
| Export (t/year) | Na | Na | Na | Na | Na |

*Source: TLHS 2004;DNAH 2008; MAP 2010; Varela; DNAH; Correia et al. 2014;MAP Municipio Manatuto; DNAH; DGE 2015; Scott et al.; MAP Municipio Manatuto 2016; MCIA Municipio Manatuto 2020 # (Conversion paddy rice to rice is 60%)*

### 7.3.10 Potentiality of local agriculture products and livestock in Aileu

Aileu is situated in the northwestern part of Timor Leste, about 47 km from the capital city. Aileu can be reached in one and half hours from Dili. The total area is 314 km2 with a total population of 48 837 people (Servico Estatistica Municipio Aileu 2015). The total household number was 7598 with the population density of 72.24 people per km2. The altitude of this area is 869 m above sea level, with the temperature of approximately 20 – 23°C (Keefer 2000). Aileu is included in the climatic zone of the northern highlands where the wet season is longer than the dry season. The wet season commences around October and lasts until May with a duration of 6 – 7 months and an average annual rainfall of more than 1500 mm. The dry season begins in June and lasts until the end of September with a duration of about 4 – 6 months.

The main source of income for the majority of the population in Aileu is agriculture (mainly horticulture and coffee). The major crops grown are vegetables, coffee, fruit, maize, cassava, sweet potato, taro and beans. The total number of households growing vegetable crops in this area is 6015 households; while coffee engages more than 6000 households (DGE 2015). The livestock raised are mostly cattle, buffalo, goats, pigs and poultry. The topography of the area is generally sloping and mountainous. Aileu has an extensive area sown to horticulture crops with a cool climate and favorable rainfall throughout most of the year. Therefore, Aileu is recognized as one of the potential horticultural production areas in Timor-Leste.

The result of the study revealed that the top five local potential agriculture products and livestock in the municipality of Aileu are **Vegetable, Coffee, Tangerine, Clove** and **Shallot.** Most of the stakeholders interviewed describe that these products play an important role in providing income and food security for most of the population in this area. Most of the income derives from vegetable products, fruit and coffee.

**Vegetable -** Aileu is known as one of the main supplier of vegetable products (mustard and others) to the main market in Dili. As the climatic condition is favorable with 6-7 months' wet season, its offer farmers more opportunities to produce different types of vegetable products with high quality for the whole year. As the volume of importation of vegetable products reduced significantly – domestic markets are depending on this area to produce more to fulfill the demand – and farmers and private sector are competing to grow more products demanding by the market. This can be seeing through the investment done by vegetable farmers and private sector (e.g., tunnels and greenhouses), which needs more capital.

The total number of households growing vegetable crops in this area is 6015 households - around 79 per cent of the total household in Aileu (DGE 2015). In terms of the production of vegetables, its increase year by year. For example, in 2012 the total production was 315,000 kilograms and in 2013 it

rise up to 352,865 kilograms (MAP Municipio Aileu 2019). This total production is deriving from *45 types of vegetables*, which includes mustard, lettuce, broccoli, cauliflower, jukini, and others. The detail of the production of vegetable in Aileu from 2012 – 2016 is shown in table below.

Table 21. Production of Vegetable in Aileu

| Year | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| **Production (Kg)** | 315,000.00 | 352,865.00 | 439,639.30 | 486,420.91 | 528,938.67 |
| **Revenue ($)** | 233,100 | 261,120 | 325,333.1 | 359,951.5 | 391,414.6 |

*Source: Map Municipio Aileu 2019*

In addition, under the USAID Avanza project which deal more with the production and marketing/business of vegetable produce reveal that in the last five years (2014-2019) Aileu produce around 350 tons of fresh vegetables (USAID 2019). Thus the number of household participated in this project accounted for 500 households.

Data from the Ministry of Agriculture and Fisheries (2014) revealed the potential for vegetable production in Aileu was 13,000 hectares. From this, there was only 1,113.14 hectares or around 8.64 per cent was planted (for 12 types of vegetables). With the average yield of 4.95 tons per hectare it resulted to the total production of around 5,000 tons in that year. The details of the area planted and production of vegetables in Aileu in 2014 is shown in Table below.

Table 22. Area planted and production of vegetables in Aileu

| Products | Area Planted (ha) | Production (t) | Yield (t/ha) |
|---|---|---|---|
| Mustard | 177.33 | 709.00 | 4.0 |
| Cabbage | 182.03 | 432.00 | 5.0 |
| Tomato | 56.60 | 424.50 | 7.5 |
| Carrot | 120.23 | 841.60 | 7.0 |
| Snow pea | 162.00 | 567.00 | 3.5 |
| Lettuce | 48.16 | 264.88 | 5.5 |
| Cauliflower | 15.50 | 66.70 | 4.3 |
| Chilly | 113.00 | 425.30 | 3.9 |
| Capsicum | 18.04 | 54.12 | 3.0 |
| Cucumber | 49.65 | 162.36 | 3.3 |

*Source: DNAH-MAP, 2014*

Most of the vegetable products (90%) produced in Aileu is destined to main market in Dili with small percentage deliver to district and local market. As a center for vegetable production, buyers come regularly in a daily basis looking for fresh vegetable produce to be distributed to Dili market. The main buyers are local traders

and collectors, supermarkets (Kmanek, W4 and Dili Mart) and some private sectors (Nova Casa Fresca) engaging in production and marketing of vegetable produce. In addition, the supply chain of vegetable products in Aileu is as follows. Producers sell their produce to Institutional buyers – then further to consumers and customers. The detail of supply chain of vegetable products is shown in Figure below.

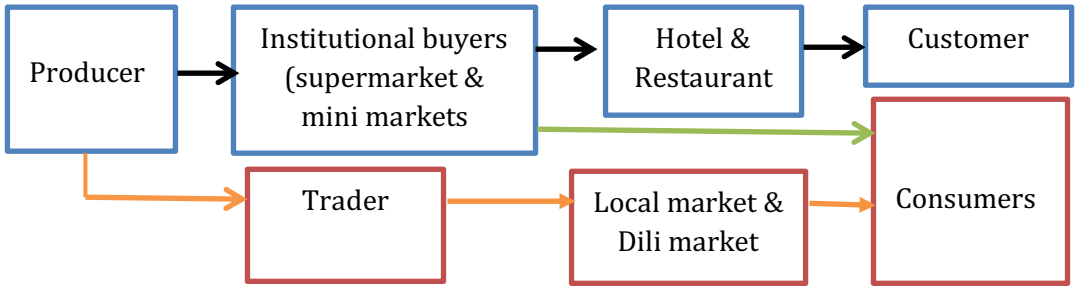



Figure 24. Supply chain of vegetable products in Aileu

In terms of prices, it depends on the types of vegetables produced and it ranges from 0.50 cents up to $2.00 per kilogram. For example, Lemon grass and Mint leave sold with the price of 0.50 per kilogram, while the price of Broccoli and Strawberry is for $2.00 per kilogram. The details of the price of some vegetable products are shown the Appendix 2. The prices shown in Appendix are farm gate prices – sell to institutional buyers, which includes Kmanek supermarket, W4, Dili Mart, Casa Nova Fresca, and others. In addition, with the average price for all vegetable products of 0.74 cents per kilogram, it can provide revenue of $259,000 for household farmers in Aileu ($518/household). This offers a significant income to rural household and also employment opportunities particularly for the youth in rural areas.

**Coffee –** The second local potential agriculture products and livestock in the municipality of Aileu is Coffee. Aileu included in the five municipalities, which is very potential for coffee production in Timor-Leste.

The types of coffee grown by farmers in Aileu are Arabica and Robusta coffee. The total household engage in the coffee production is 6244 household or 82.2% of the total household (DGE 2015). The total area for Arabica coffee is 1,804 hectares. From this, around 1590 hectares are already producing with the total production of 212.25 tons per year (MAP Municipio Aileu 2017). This mean the productivity of Arabica coffee is around 0.14 tons per hectare. In addition, the total area for Robusta coffee is 86 hectares with the production of 13.5 tons per year (MAP Municipio Aileu 2017). The level of productivity in this area is lower than national average of 0.30 tons per hectare (MAP 2017). Therefore, there is still opportunity to improve the level of productivity as far as farmers applying good agricultural practices in managing their coffee.

Coffee produced by farmers in Aileu mostly is selling to the market with the main buyer Cooperativa Café Timor (CCT). The main market for this product is foreign market, which includes USA, Australia, Japan and New Zealand. There is only a small percentage of coffee is selling to domestic market. Most coffee produce in Aileu is organic coffee. In addition, the demand for Timor-Leste's coffee is high, however the production is very low. To fulfil the demand for export market, improving the productivity is an option that need to be taken into consideration.

In terms of prices, producers in Aileu receive 0.32 cents per kilogram of cherry, which according to most producers this price is very low. Even though the price offered is low however, the sustainability of the market is guaranteed. The contribution of coffee sector to the national economy is very important – as coffee still remains as Timor-Leste's major export.

**Tangerine –** Another local potential agriculture products and livestock is Tangerine. The main production area of tangerine is in the sub-district of Lequidoe – indeed in other parts of Aileu are also grown tangerine including Laulara, Aileu Vila and Remexio.

According to DGE (2015), the total household engage in the production of fruit (permanent) in Aileu was 5399 households – and this includes tangerine. The total area planted for tangerine in 2012 was 24.37 hectares, and in 2013 the area expanded to 25.59 hectares (DNAH-MAP 2014). In addition, the total production for the same year was 536.14 and 255.90 tons respectively. This shows that the total production is going down sharply about 280 tons at that time. The decrease in production occurred as a result of some tangerine trees get older and also lack of management. The yield for tangerine in Aileu was 10 tons per hectare (DNAH-MAP 2014); and this is lower than Indonesia of 21 tons per hectare. The detail of the area planted and production is shown in Table 23.

Table 23. Area planted and production of Tangerine in Aileu

| Description | Year | |
|---|---|---|
| | 2012 | 2013 |
| Area planted (ha) | 24.37 | 25.59 |
| Production (ton) | 536.14 | 255.90 |
| Yield (ton/ha) | 22 | 10 |

*Source: DNAH-MAP 2014*

Most of the tangerines produced are distributed to the main market in Dili. Some small quantities of tangerine are selling through street corners in Aileu and along the way from Dili – Aileu. The main buyers are traders and collectors who purchase

tangerine regularly – and deliver to the market. The main season for tangerine in Aileu is from April until May. Thus, producers normally sell tangerine in sack, bucket, whole tree, and also per fruit. Some buyers bought the whole trees for $150 – 500; this is higher compared to tangerine in Ermera which sold for $100-200 per tree. Thus, others bought 4 tangerine fruits for $2.00.

In addition, one hectare of land can be planted 500 tangerine trees (Badang Litbang Pertanian 2012). With the area planted of tangerine of 25.59 hectares in 2013, this means it can be planted around 12,800 tangerine trees (assume 1 ha = 500 trees). Thus, with an average production of 35 kilograms per tree, this will produce around 448 tons tangerine per year. With an average price of $325 per tree this will generate revenue of $4,160,000 annually. If assume that 5399 households in Aileu produce tangerine, it provides an annual income of $770.50 per household.

**Clove –** As the climatic condition of some parts in Aileu that is quite cool as it located in high elevation therefore it is quite favorable for clove to grown. Area that is quite potential for clove is in the sub-district of Laulara and some parts of Remexio and Aileu Vila. The Total area of clove in Aileu was 74 hectares. From this, 38 hectares are already produce (MAP Aileu 2017). The total production is 30 tons per year with the productivity of 0.79 tons per hectare. There is no data on how many households involve in the production of cloves however, this product is an export product with the destination of Indonesian market.

The demand for clove in Indonesia is around 120,000 tons per year and from this there is only around 80,000 tons that can be produced domestically (Dirjen Perkebunan Kementrian Pertanian 2013). According to FAO (2017), Indonesia included in the top 3-imported country for clove in the world with the total import in 2016 of 6952 tons. As a cigarette factory increase drastically it affects the demand for clove in Indonesia (clove is one the primary product for producing cigarette). This offers an opportunity for Timorese producers and private sectors to engage more in the production of clove so that it can maximize the volume of export annually. Indeed, the productivity of clove in Timor-Leste is 0.79 tons per hectare, which is higher than Indonesia of only 0.31 tons per hectare.

Most clove produce in Aileu is destined to Indonesian market. The main buyer is Cooperativa Café Timor (CCT) and some local traders who has link with Indonesian buyers in Atambua-Indonesia (see supply chain on Figure 3). The price offered by CCT is $3.25 per kilogram for dry clove. In addition, the current price of clove in Indonesia is $2.50 (Rp35, 000) per kilogram for wet clove and $6.80 (IDR 95,000) for dry clove (1 dollar = IDR14, 000). With the price offered of $3250 per ton, it can provide revenue of $97,500 annually. This contributed significantly to the stakeholders (e.g.,

producers, traders, agribusiness firms and cooperatives) that engage in the production and marketing of clove in Timor-Leste.

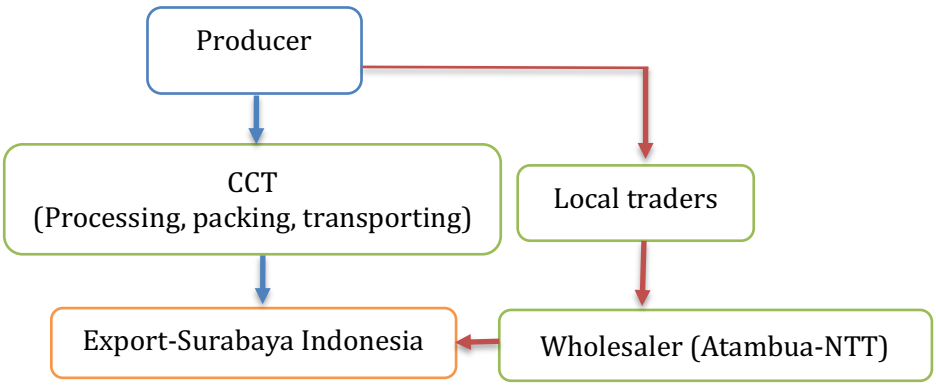



Figure 25. Supply chain of clove in *Aileu*

**Shallot –** It is one of the local potential agriculture products in Aileu. The area potential for shallot in Aileu including Aileu Vila and Remexio and this crop is grown well in elevated areas of 400 meters above sea level. As reported by Directorate of Agriculture, Horticulture and Extension (2013) the major shallot production areas are including Aileu, Baucau, Viqueque and Ainaro in particular in the higher altitude areas.

The total area planted of shallot in Timor-Leste in 2012 was 356.7 hectares (DAHE-MAP 2013). With an average productivity of 2.81 it resulted in a total production of 1160.7 tons (see Table 23). This average yield is much lower than Indonesia of 9.6 tons per hectare. To increase the yield, it is important to improve farm management practices, which will lead to a more intensive production. Thus, the yield could also improve through the use of improved quality planting material, and increased use of fertilizers and fungicides (TOMAK 2016). The planting season generally occurred in April/May, with harvest in around July/August.

Table 24. Area planted and production of shallot in Timor-Leste (2011-2012)

| Municipality | Area Planted and Production | | | | | |
|---|---|---|---|---|---|---|
| | 2011 | | | 2012 | | |
| | Area planted (ha) | Production (t) | Yield (t/ha) | Area planted (ha) | Production (t) | Yield (t/ha) |
| Aileu | 80.5 | 284 | 3.53 | 82.1 | 295 | 3.59 |
| Ainaro | 75 | 255 | 3.40 | 75.3 | 256 | 3.40 |
| Baucau | 49 | 155 | 3.16 | 50 | 155 | 3.10 |
| Bobonaro | 18 | 62 | 3.44 | 20.9 | 62.7 | 3.00 |
| Covalima | 13 | 33.8 | 2.60 | 13 | 33.8 | 2.60 |
| Ermera | 8 | 25.6 | 3.20 | 8 | 25.6 | 3.20 |
| Liquica | 3 | 7.8 | 2.60 | 3 | 7.8 | 2.60 |
| Lautem | 13 | 34.8 | 2.68 | 13 | 34.8 | 2.68 |
| Manatuto | 11.2 | 31.2 | 2.79 | 10.2 | 30.6 | 3.00 |
| Manufahi | 8 | 24 | 3.00 | 8 | 24 | 3.00 |
| Oecusse | 6 | 17.4 | 2.90 | 6 | 17.4 | 2.90 |
| Viqueque | 68.2 | 218 | 3.20 | 68.2 | 218 | 3.20 |
| Total | 532.9 | 1148.6 | - | 356.7 | 1160.7 | - |
| Average | - | - | 2.81 | - | - | 2.82 |

*Source: Directorate of Agriculture, Horticulture & Extension – MAP, 2013*

In addition, the area planted for shallot in Aileu is up and down. Data from Ministry of Agriculture and Fisheries shows in 2011 the total area planted was 80.5 hectares, in 2012 around 82.0 and in 2014 was 80.1 hectares (DAHE 2013; DNAH 2014). In terms of production, it was increase sharply. For example, in 2011 the production was 284 tons, 2012 about 295 tons and in 2014 it rose up to 600.75 tons. Thus, the average productivity was 4.87 tons per hectare. The details of area planted, production and productivity of shallot in Aileu are shown in Figure below.

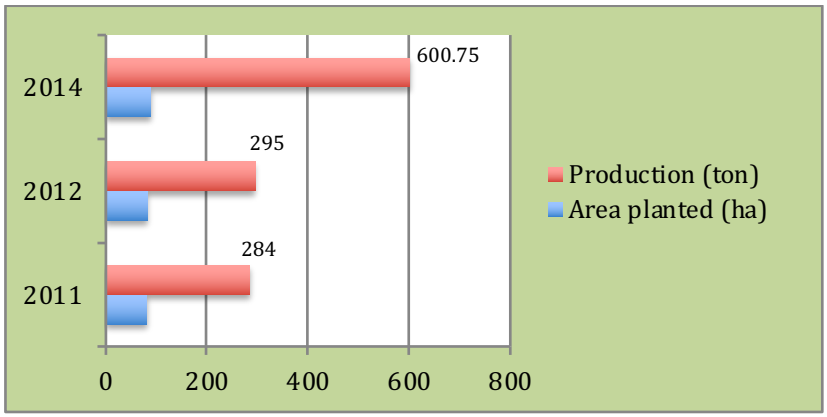



Figure 26. Area planted and production of shallot in Aileu

Most of the shallot produced in Aileu is selling through local markets (Aileu and Maubisse market) with small volume deliver to Dili market. There is lack of market opportunities as imported shallot distributed and selling across local markets including village and district markets. The main buyers are traders, retailers and consumers in Aileu and surrounding districts. In terms of price, it cost $1.00- 1.50 per

kilogram. In addition, most producers and retailers in local markets selling shallot not in a standard weight such as kilogram but in 'bunch'. One bunch sold for 0.50 cents up to $1.00.

Meanwhile, shallot is in high demand in Indonesia because this product is a key ingredient for Indonesian cuisine. AIP-PRISMA (2015) revealed that from 2008 – 2012 the national consumption of shallots averaged 1.04 million tons per year. To fulfill the domestic consumption, Indonesia imports an average of 110,000 tons (7-15%) of shallot annually – and most of this product is imported from Thailand, Philippines, Vietnam, India and Myanmar.

Geographically Timor-Leste is very close to Indonesia. Therefore, the demand for shallot in Indonesia market provides an opportunity for producers and private sectors to fulfill the demand offered by that market. This can be done through the involvement of stakeholders including public and private sectors, producers and actors engage in the supply chain. If assumed that the productivity of shallot in Timor-Leste can be increase by 5.6 tons per hectare (rise 100%) it will result in a total production of 1,997.52 tons per year – this will provide revenue of about $299,628 annually. If this quantity can be exported to Indonesia it only fulfills 1.82 per cent of the total demand of shallot in Indonesia annually. This means market opportunity is open widely for Timor-Leste however, whether stakeholders engage in this commodity can fulfill the standard demanding by the market including quantity, quality and sustainability of the product. If Timor-Leste can maximize its effort to fulfill some of the demands of shallot in Indonesian market it will generate significant revenue to the country.

Table 25. Description of local potential agriculture products and livestock in Aileu

| **Description** | **Top 5 local potential agriculture products and livestock** | | | | |
|---|---|---|---|---|---|
| | **Vegetable** | **Coffee** | **Tangerine** | **Clove** | **Shallot** |
| Household number | 6015 | 6244 | 5399 | Na | Na |
| Production (t/year) | 528.94 | 225.75 | 255.9 | 30 | 600.75 |
| Productivity (t/ha) | 4.95 | 0.22 | 10 | 0.79 | 4.87 |
| Main market | Dili | Canada, Australia, USA & Japan | Dili | Indonesia | Local market |
| Average price ($/kg) | 0.74 | 0.32 | 325/tree | 7.5 (dry) | 1.25 |
| Consumption level (kg/cap/yr) | Na | Na | Na | Na | Na |
| Demand (t/yr) | Na | Na | Na | Na | Na |
| Current supply (t/yr) | 528.94 | 225.75 | 255.90 | 30 | 600.75 |
| Export (t/year) | Na | 10,712.7 (TL) | Na | Na | Na |

*Source: DAHE-MAP2013; DNAHE-MAP 2014; DGE 2015; MAP Municipio Aileu 2017; CCT 2019; USAID 2019; MAP Municipio Aileu 2019*

### 7.3.11 Potentiality of local agriculture products and livestock in Manufahi

Manufahi is one of the municipalities that are situated in the southern part of Timor-Leste. It lies in the south coast of Timor-Leste, on the Timor Sea; in the east bordered with Manatuto; in the west with Ainaro; and in the north bordered with Aileu. Administratively Manufahi composed of four sub-districts and 29 villages. These sub-districts are Same Vile, Alas, Fatuberliu and Turiscai.

The total area is 1,326.60 square kilometers with the total population of 53,691 people (DGE 2015) and the total household of 9,023. The household size is 5.95 with population density of 40.5 people per square kilometer.

Most of the households in Manufahi depend on agriculture as a source of livelihood and income. The total potential area for agriculture is 20,332 hectares. From this, there is only 2286.1 hectares are planted – or only 11.24 per cent of the total potential area was cultivated (MAP Municipio Manufahi 2016). The major crops cultivated by most of the population in Manufahi are including maize, cassava, sweet potato, horticulture crops, paddy rice and others. Meanwhile livestock that generally raised by population in this area are cattle, buffalos, goats, chicken and horse and others. Farmers generally still applied traditional and semi-traditional system in managing their farm with some is moving from subsistence to commercial farming. The details of potential area and planted area are shown in Table below.

Table 26. Area potential and area planted for agriculture in Manufahi

| Crops | Potential area (ha) | Planted area (ha) | % |
|---|---|---|---|
| Maize | 12,000 | 1536.3 | 12.80 |
| Cassava | 1500 | 19 | 1.27 |
| Sweet potato | 200 | 131.25 | 65.63 |
| Potato | 50 | 5 | 10.00 |
| Soybean | 250 | 7 | 2.80 |
| Mungbean | 250 | 7 | 2.80 |
| Taro | 500 | 12 | 2.40 |
| Kontas | 100 | 14 | 14.00 |
| Paddy rice | 3908 | 474.55 | 12.14 |
| Legume | 389 | 22 | 5.66 |
| Horticulture | 285 | 58 | 20.35 |
| Total | 20,332 | 2286.1 | |

*Source: MAP Municipio Manufahi, 2016*

The result of the study shows that the top five local potential agriculture products and livestock in the municipality of Manufahi are **Cattle, Maize, Paddy rice, Banana** and **Mungbean**. Stakeholders interviewed mostly describe that these products play an important role in providing food security and also income for most of the population in Manufahi. Cattle for example, provide a significant income for rural household in this area; and maize, cassava and sweet potato becomes an important diet for population in Manufahi.

**Cattle –** One of the main areas of supplying cattle to Dili market is Manufahi. This area is very potential for cattle production in Timor-Leste as there is an availability of natural pasture throughout the lowland from Betano until Fatuberliu. The total household engage in cattle production was 3183 households (DGE 2015). In addition, the total number of cattle raised increase sharply. For example, from 2017 was 16,940 heads, 2018 around 17,700 and 2019 was 18,143 heads (MAP Municipio Manufahi 2020). Based on the number of cattle in 2019 and the total household engage in raising cattle – it means the average cattle owned is six cattle heads per household. The details of the number of cattle in Manufahi from 2015 – 2019 is shown in Table 27.

Table 27. Number of cattle in Manufahi from 2015 – 2019

| Year | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Number of Cattle** | 14,148 | 16,134 | 16,940 | 17,787 | 18,143 |

*Source: DGE 2015; MAP Municipio Manufahi 2020*

The main market of cattle from Manufahi is Dili market. Data from Ministry of Agriculture and Fisheries (Transit station) shows that the total of cattle deliver to Dili from 2017 to 2019 was 2857 heads (MAP Municipio Manufahi 2019) – average 952 heads per year; and this not include those cattle's distributed to Dili without license (approximately 80%). In addition, the main buyers are butcher in Dili and local traders.

In terms of price, it depends on to whom the cattle will be selling to. If it is selling to the butcher in Dili, the price is based on 'live weight' of cattle – for example, if the cattle live weight is less than 200 kilograms the price is $2.00 per kilogram; 200 – 249 the price is $2.50; 250 – 299 it is $2.70; and more than 300 kilograms the price is $2.75. But if cattle are selling through local trader, the price will be based on the physical appearance, age, demand, and so on - for this the price will range from $200 - $800 (average $500/head).

Assumed that in one-year producer can sell two cattle (live weight) of around 250 kilograms – it will generate an income of $1620 annually. Indeed, the demand of bovine meat in Dili market is high around 800 tons annually (Scott el al. 2016). To fulfill this market, it needs around 8000 cattle per year. In addition, the demand of bovine meat in Manufahi from 2017-2019 was 35.4 tons (MAP Municipio Manufahi 2019) – this means yearly demand of bovine meat is 11.8 tons (118 cattle's/year).

The supply chain for cattle in Manufahi is as follows. For producers who sell cattle's to butchers in Dili (fixed price), they normally deliver directly to butcher owner in Dili. For those who sell through local trader – trader generally come around looking for cattle to purchase (based on negotiation). If agree, then they will buy and distributed to the slaughterhouse in Dili.

The detail is shown in Figure below.

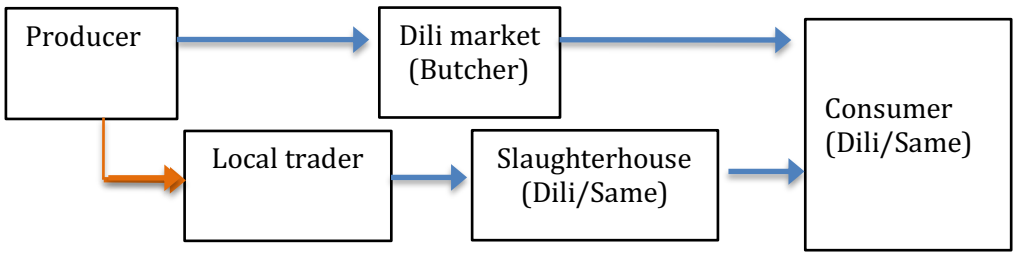
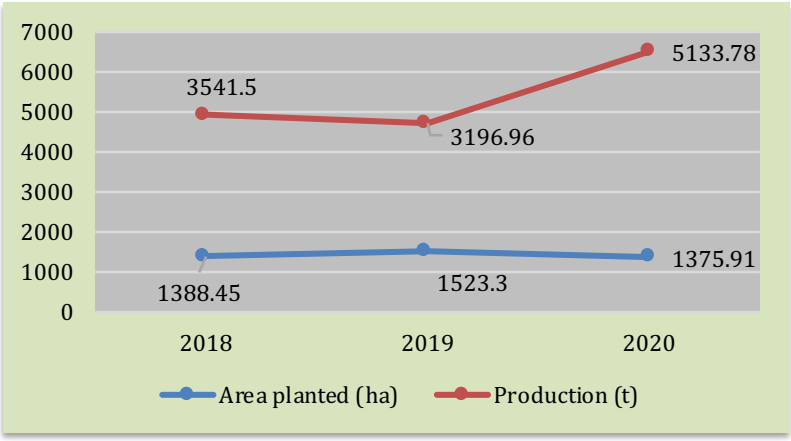



Figure 27. Supply chain of cattle in Manufahi

**Maize –** It is one of the potential agriculture product in the municipality of Manufahi. This crop mostly grown by farmers in the lowland areas such as in Betano and along the way to Fatuberliu, which constituted of flat land and favorable climatic condition in particular in the south coach. There are also some farmers cultivated in upland areas but the production is not as good in the lowland areas.

According to DGE (2015) the total household engage in the production of maize is 7039 households (78% of the total household). The total area planted in 2019 was 1523.30 hectares with the total production of 3196.96 tons per year and the average yield of 2.48 tons per hectare. The detail of area planted, production and yield of maize in Manufahi in the last three years is shown in Figure below.




*Source: MAP Municipio Manufahi 2020*

Figure 28. Area planted & production of Maize in Manufahi

Figure above shows that even though the area planted decrease slightly in 2020 however, the production of maize for the same year increase significantly by 1936.82 tons - and this indicated there is an increase in the productivity of maize.

The main market of maize from Manufahi is Dili market and surrounding districts. An interview with maize producers in Betano revealed that local traders from Baucau,

Manatuto, Ainaro, Ermera and Aileu normally purchase maize from Manufahi and sell it to the consumers. However, he added there is lack of market opportunity for this product as the quantity of maize sold is very small. In addition, the price offered is 0.35 cents per kilogram ($8/sack of 25 kg and $15/sack of 50 kg). If assumed that a half of the current production (2133.78 tons) is sold with the price as mentioned ($350/ton), it will generate revenue of $746,823 annually ($106.10/household).

**Paddy rice –** This crop grown well in the lowland areas with good irrigation scheme such as in Betano with permanent irrigation of 'Karau Ulun' and some areas are dependent on rain water (rainy season is longer than dry season). According to DGE (2015) the total household involves in the production of paddy rice in Manufahi was 2586 household. The total area cultivated in 2018 and 2019 was 429.68 and 451.75 hectares respectively. This resulted in a total production of 1471.90 tons in 2018 and 1056.28 in 2019 with the productivity of 3.43 and 3.71 tons per hectare. (MAP Municipio Manufahi 2020).

Paddy rice in Manufahi considered as food crop and also cash crop. It is preferred staple for most people in Manufahi. The dominant rice systems in this area are dominated by rain fed lowlands and rain fed uplands. This crop mostly planted once a year with some areas such as Fatuberliu grown twice a year. Planting season started in December/January and harvesting season begin in May/June.

Most paddy rice produced is for own consumption - as there is lack of market for this product. There are only small quantities are selling to the market. The main market is local market around Manufahi and in some cases Centro Logistica Nacional (CLN) came to purchase the product but in a very limited volume. Indeed, locally produce rice cannot compete with imported rice as it is cheaper and good quality, and it is marketed through the villages and sub-villages throughout the year. The main buyers are local traders and consumers in Manufahi and surrounding municipalities. This directly or indirectly affect the motivation of local producers to increase the production of paddy rice. In terms of price, for paddy rice it is sold for 0.40 per kilogram; while local rice sold for $1.00 per kilogram.

With the total population of 53,691 people and the per capita consumption of 95 kg per year, it means the demand for rice in Manufahi is around 5100 tons annually. In terms of supply, Manufahi can only produce around 633.77 tons of rice per year (rate paddy rice to rice is 60%). This shows that the current production of rice cannot fulfill the demand needed by the population in Manufahi. There is a deficit of about 4466 tons per year. To fulfill the demand, it is important to increase production through open up more land and increase the productivity per hectare. This can be done through providing more assistance and support to the producers and provide

more market opportunities for this product. To achieve this, public and private sectors support are needed. Thus it is important to have a target of reducing an importation of rice periodically so that by the time most of rice consumed by Timorese people will be produce domestically – This will have further implication to the income of rural household in this country.

**Banana –** Another potential agriculture product in Manufahi is Banana. The area that is very potential for banana production is Betano, Clacuc and Fatuberliu. The types of banana grown mostly are 'Hudi fatuk". The total area planted for banana in Manufahi is 31.5 hectares – this produces around 358 tons of bananas per year with the productivity of 12.5 tons per hectare (DNAH-MAP 2014). The productivity of banana in Manufahi is higher than average national which accounted for about 9.77 tons per hectare – and slightly lower than the average yield of banana in Philippines of 13.3 tons per hectare (IFPRI; Bathan & Lantican 2010). Indeed, low productivity is caused by the lack of crop management, low skill of producers and intensive use of local seeds.

In addition, for areas with potential for banana production such as Betano and others, the income of the majority of the population is generated from banana. Most of banana produced is for selling to the market. The main market for this product is Dili market with small volume deliver to local market; and the main buyer is traders and collectors who comes regularly in a weekly basis to purchase banana and distributed to Dili market (e.g., Taibessi & Manlewana market). This product offers significant revenue for actors engage in the supply chain such as producers, traders, collectors, retailers and truck owners. This means that in terms of market it is good and prosperous market for this product in the future – as the demand for banana in Dili is quite high.

Most producers in Manufahi sell banana in a 'bunch'. The average price of one big bunch is $2.00 (one big bunch composed of 15 small bunches). The average weight of a big bunch is 20 kilograms and small bunch is 1.34 kilograms. An interview with Lead banana farmer Mr Francisco Soares in Betano revealed that buyers come regularly to his farm to buy banana. He added, in one week he sold an average of 120 big bunch banana with the price from $1.5 – $2.00 per bunch – this means every week Mr Soares will receive $210. This offers a significant income for rural producers and their families in rural areas.

A study done by Correia et al. (2015) reveal that the weight of one big bunch is about 20 kilograms while for small bunch is about 1.34 kilograms. This means one-kilogram banana will cost about 0.10 cents. In addition, traders sell bananas to retailers with $5 – 6/big bunch. Thus, retailers normally sell the banana to institutional customers and

consumers in small bunch with the price range from $0.75 cents – 1.0. It means that one big bunch of banana will cost around $13.0.

**Mungbean –** This crop is a short crop-growing season, which can be planted after paddy rice or maize. In the Strategic Plan 2011-2030 describe that this product could be one of the potential export product for Timor-Leste. The production of mungbean in Timor-Leste is concentrating in the south coast including Covalima, Manufahi, Manatuto and Bobonaro.

In Manufahi, this crop generally grown well in lowland areas, which includes some parts of Same Vila, Alas and Fatuberliu. It is one of the local potential agriculture products in Manufahi. The potential area for mungbean in this municipality is 250 hectares. From this, the cultivated area in 2016 was only seven hectares, and the total production for the same year was 5.60 tons with the productivity of 0.80 tons per hectare (MAP Municipio Manufahi 2016). This level of productivity is lower than national average of 1.3 tons per hectare.

Indeed, the production level can be increase through the expansion of area planted, used of inputs and applying good management practices in managing the farm. According to TOMAK (2016), there are technologies available which can use to increase mungbean productivity, and these include use of new variety seed, direct sowing into rice stubble, good storage and applying small amounts of P fertilizer. As for Manufahi, there is an opportunity to maximize the potential area available because so far only cultivated 2.80 per cent of the potential area destined for mungbean.

In terms of the system of production for mungbean in Manufahi, it constituted of two systems, which includes lowland system – as a monocrop on cultivated level areas; and upland system – cultivated among maize. In addition, in most lowland areas in south coast including Manufahi, mungbean generally planted as monoculture crop in May/June.

Most of mungbean produced in Manufahi is for selling to the market – the main market is Dili and local markets and the main buyers are local traders and collectors. In addition, Indonesia is one of the potential markets for mungbean as the annual demand is around 50,000 tons (Dirjen Tanaman Pangan 2012). This offers an opportunity for Timorese producers and private sectors to respond to this demand. So far Indonesia imported mungbean from Etiopia, Myanmar, Thailand, Australia and Brasil. If Timor-Leste can fulfill some of the demand offered by Indonesian market - it could provide a substantial contribution to household income in rural areas.

Table 28. Description of local potential agriculture products and livestock in Manufahi

| Description | Top 5 local potential agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | **Cattle** | **Maize** | **Paddy rice** | **Banana** | **Mungbean** |
| Household number | 3183 | 7039 | 2586 | Na | Na |
| Production (t/year) | 1814.3 (B.meat) | 5133.78 | 633.77 (rice) | 358 | 5.60 |
| Productivity (t/ha) | 6 head/hh | 2.48 | 3.43 | 12.5 | 0.80 |
| Main market | Dili & Manufahi | Dili & local markets | Manufahi | Dili | Manufahi & Dili |
| Average price ($/kg) | 2.70 (live weight) | 0.35 | 0.40 (Paddy rice) | 2/big bunch | Na |
| Consumption level (kg/cap/yr) | 1.19 | 90 | 95 | Na | Na |
| Demand (t/yr) | 83.89 | 4831.19 | 5100.6 | Na | Na |
| Current supply (t/yr) | 1814.3 | 5133.78 | 633.77 | 358 | 5.60 |
| Export (t/year) | Na | Na | Na | Na | Na |

*Source: TLHS 2004; DNAHE-MAP 2014; Calisto 2014; DGE 2015; MAP Municipio Manufahi 2016 & 2020 * Conversion paddy rice to rice is 60%.*

### 7.3.12 Potentiality of local agriculture products and livestock in Ainaro

Ainaro is one of the municipalities in Timor-Leste, which situated in the southern part of the country. The total area is 869.80 square kilometer with the total population of 63,136 people (DGE 2015). The total household is 10,600 with household size of 5.94 and population density of 72.59 per square kilometer. Administratively, Ainaro composed of four sub-districts and 21 villages. These sub-districts are Ainaro Vila, Maubisse, Hatubuilico and Hatu-Udo.

The source of livelihood and income for most households in Ainaro is deriving from agriculture sector (e.g., horticulture, industrial crops, cash crops, food crops, livestock and fisheries). Total area potential for agriculture in Ainaro was16, 126 hectares and from this only 3546.5 hectares was planted or 22 per cent of the potential area (MAP Municipio Ainaro 2015).

The major crops planted by most of population in Ainaro are maize, cassava, sweet potato, horticulture crops, coffee and others. Meanwhile livestock raised includes, cattle's, buffalos, chicken, horse, pig and others. In general, farmers still applied traditional and semi-traditional system in managing their farm.

The result of the study shows that the top 5 local agriculture products and livestock that are potential in Ainaro are **Coffee, Maize, Red bean, Cabbage,** and **Carrot**. These products are potential because it engages a significant number of household in the production and marketing; contributed to the livelihood and income of most of the household in Ainaro; availability of the market both domestic and export market; and these products contributed to the overall economy of the municipality of Ainaro.

**Coffee –** Ainaro is one of the municipality in Timor-Leste that is very potential for coffee. Based on the interviews and discussions with stakeholders involve in this study, it reveals that Coffee become the first local potential agriculture product from Ainaro. Nationally, coffee is the main export product since Portuguese time until now. Its involve a significant number of household in the production, processing and marketing of this product. As a results its offer sustainable revenue for coffee producers in coffee production center in Timor-Leste.

Direção Nacional do Café e Plantas Industrias – MAP (2015) reveal that potential area for coffee production in Ainaro are Maubisse, Ainaro Vila and Hatubuilico with the total area of 5696 hectares. Meanwhile the total production was 2540 tons with the productivity of 0.45 tons per hectare – this is higher than national average of 0.31 ton per hectare. In addition, the total number of household involve in coffee sector is 6986 households (DGE 2015). According to MAP Municipio Ainaro (2017), the number of coffee tress grown by farmers in Ainaro totaling 8,570,479 trees (productive & non-productive), and the type of coffee planted mostly are Arabica coffee.

Most coffee produced in Ainaro are destined to export market, with only small volume distributed through domestic market. The main buyers are CCT and Parcic from Japan. These buyers have their own operational office in Maubisse. Most coffee bought is Arabica coffee – and it must be organic. The price of one-kilogram coffee cherry is 0.32 cents, while for dry bean it cost $2.15 per kilogram.

The demand for Timorese coffee is high, however the production is very low. To fulfil the demand for export market, improving the productivity is an option that need to be taken into consideration. Indeed, maintaining the current market for 'organic' coffee is also important.

**Maize –** Most people in Ainaro grown maize as source of food security and also income. According to DGE (2015), the number of household grown maize in Ainaro totaling 9476 households ( 89.39% of the total household in Ainaro).

The variety of maize planted in Ainaro composed of Sele, Bisma and local variety. The potential area of maize in Ainaro is around 10,000 hectares. In addition area planted is 1332 hectares and harvested area totaling 1029.2hectares (MAP Municipio Ainaro 2020). The total production is 5549.7 tons with the productivity of 5.39 tons per hectare (higher than national average of 2.80 t/ha). If a half of the potential area is planted (maintain current yield), it will produce around 26,950 tons of maize annually.

In terms of market, there is lack of market opportunities for maize in Ainaro. Producers normally sell maize through local markets and the quantity sold is very

small. Buyers are local traders and consumers who bought maize in a limited volume. The price of maize is 0.50 cents per kilogram; and for seed $1.50 per kilogram.

Based on per capita consumption of maize 90 kilograms per year, it means Ainaro will need around 5682.24 tons of maize per year. In addition, the current supply is 5549.7 tons annually (MAP Municipio Ainaro 2020). If there is an availability of market and assumed that 50 per cent of the current supply is sold with the price of 0.50 cents per kilogram, it will provide revenue of $1,387,425 per year ($146.41/household/season). To improve the income of maize producers, it is important to increase production and this can be done through use of good varitey seeds, apply good crop management practices and maximize the use of potential land for maize cultivation.

**Red bean –** This crop grown well in Ainaro in particular in areas with high elevation (1400 – 2000 m above sea level) such as Hatubuilico, Maubisse and some parts of Ainaro Vila. The number of household involve in beans production is 5922 household (DGE 2015) – this including red beans. The potential area for red bean in Ainaro is 240 hectares – from this its only 120 hectares are planted. The total production around 300 tons per year with the productivity of 2.50 tons per hectare (Agricultura Municipio Ainaro 2017).

Most red beans produced is deliver to market and the main market is local markets, with some quantities selling to Dili market. The main buyer are local trader and collectors who bought this product and sell it to the market. Producers normally sell red bean in a *'Can'* (small and big) and sack. The price is depending on availability of the product. When it is a sesaon for red bean, the price is a little bit cheaaper; but if not in the season the price will go-up. For small '*can*' it cost 0.50 – $1.00 per can; for big *can* $45 - $50.

**Cabbage –** It is one of the horticulture crops that grown and produce by most of producers in Ainaro particularly in Hatubuilico and Maubisse. These areas are well known as production center for cabbage in Timor-Leste. Because of that it contribute significantly to the income of small producers in rural areas in Ainaro.

In addition, the total area planted for cabbage is 182.02 hectares with the production of 675 tons and the productivity of 3.71 tons per hectare (DNAH-MAP 2014). This productivitiy is slightly hihgher than national average of 3.09 ton per hectare. The productivity of cabbage can be increase by up to 20 tons per hectare as far as it is grown under good conditions and use of good seed varieties (FAO 2006; MAC 2008).

The majority of cabbage produce is for selling to Dili (supermarket and wet markets) with small volumes deliver to local markets, and the main buyers are local traders and Dili supermarkets. Cabbage can be sold in advance when producers started to grow cabbage or when it is havested time. In Ainaro, traders normally bought in bulk or in advance payment. Meanwhile some supermarkets operated regularly in a weekly basis to purchase cabbage and other vegetables. The average price for one kilogram cabbage is 0.50 cents (2-3 cabbages). An interview with cabbage producer and also trader Mr Manuel Mendonca reveal that if cabbage season (April-July) he can deliver in a weekly basis 1500 cabbages (one truck) to Dili market (Taibessi and Manlewana market). Mr Mendonca bough one cabbage for 0.25 cents in Ainaro and sell to Dili market for 0.25 - 0.50 cents per cabbage. If 80 per cent of the cabbage produced in Ainaro sold to the market it will provide an extra income to producers of $270,000. This can help rural household cope with basic necessities, school fees, and other cultural ceremonies.

**Carrot –** Ainaro is also known as one of the municipalities in Timor-Leste that is very potential for carrot production in particular in the sub-district of Hatubuilico and Maubisse. In addition vegetable crops grown by producers in Ainaro not only carrot but also cabbage, snow peas, mustard, lettuce, beans, garlic and shallot.

The potential area for carrot in Ainaro is around 300 hectares and from this producers can only planted for 186 hecatres (MAP Municipio Ainaro 2015). The total production is 664.02 tons and the productivity is 3.5 to per hectare. This is very low compared to the productivity of wortel in Indonesia of around 19 tons per hectare (Mardin & Anwar 2017). Despite vegetable crops growing well in this area, the productivity is very low. This is due to the lack of crop management, low skill of farmers, low input use and extensive use of local seeds. Due to the suitability of agronomic and climatic conditions and farmers' experience in growing vegetables in these areas, the yield of these crops can be increased given the right management, resources, inputs and training.

In addition, the income of people in Ainaro in particular Maubisse and Hatubuilico is generated from vegetable including carrot. This reflects the large quantity of products sold to the market in the area. A study done by Correia (2008) reveal that around 90 per cent vegetable products produced were sold to the market. The main market for carrot is local markets (district and sub-district markets) with some quantities deliver to Dili market and the main buyers are traders and retailers. The price offer for carrot in Ainaro is $1.00 per kilogram.

Table 29. Description of local potential agriculture products and livestock Ainaro

| Description | Top 5 local potential agriculture products and livestock | | | | |
|---|---|---|---|---|---|
| | **Coffee** | **Maize** | **Red bean** | **Cabbage** | **Carrot** |
| Household number | 6986 | 9476 | 5922 | Na | Na |
| Production (t/year) | 2540 | 5549.7 | 300 | 675 | 664.02 |
| Productivity (t/ha) | 0.45 | 5.39 | 2.50 | 3.71 | 3.50 |
| Main market | Export | Local market | Local market | Dili | Dili |
| Average price ($/kg) | 0.32 | 0.50 | 1.00 | 0.50 | 1.00 |
| Consumption level (kg/cap/yr) | Na | 90 | Na | Na | Na |
| Demand (t/yr) | Na | 5682.24 | Na | Na | Na |
| Current supply (t/yr) | 2540 | 5549.7 | 300 | 675 | 664.02 |
| Export (t/year) | 10,712.7 (TL) | Na | Na | Na | Na |

*Source: DNAHE-MAP 2014; DGE 2015; MAP Municipio Ainaro 2015; 2017;2020; Direcao nacional Plantas Industriais-MAP 2015*

## VIII. MARKETING OF LOCAL POTENTIAL PRODUCTS AND LIVESTOCK IN TIMOR-LESTE

Most of the local potential agriculture products and livestock produced in Timor-Leste are for selling to the market both domestic and export market. Indeed, some local potential products lacking buyers and market opportunities however, producers can still deliver the products to the market.

The main buyers for these potential products are including traders, collectors, supermarkets, agribusiness firms, cooperative, NGOs and Centro Logistica Nacional. For example, vegetable products supermarkets are the main buyer – meanwhile products such as cattle, banana, clove, copra, candlenut, traders and collectors are the main purchaser. In addition, food crops such as maize, paddy rice and sweet potato, the main buyers are local traders and local consumers – and these products generally only sell in local markets. For export products such as coffee and vanilla, so far agribusiness firms and cooperative (e.g., CCT, Timor Global, etc.) that purchase these products in large quantities.

The main market for local potential agriculture products and livestock identified in this study includes Dili market (e.g., supermarkets and wet markets), export market (USA, Japan, Australia, New Zealand, Indonesia and Canada), and local markets (e.g., village, sub-district and municipality markets). The detail of the main market for local potential agriculture products is shown in Table below.

Table 30. Main market for local potential agriculture products and livestock

| Product | Main market | | |
|---|---|---|---|
| | Dili market | Local market | Export market |
| Coffee | **x** | x | √ |
| Vanilla | x | x | √ |
| Clove | x | x | √ |
| Copra | x | x | √ |
| Candlenut | x | x | √ |
| Paddy rice | √ | √ | x |
| Maize | x | √ | x |
| Cassava | x | √ | x |
| Sweet potato | x | √ | x |
| Vegetable products | √ | x | x |
| Cattle | √ | x | x |
| Shallot | √ | √ | x |
| Mungbean | √ | √ | x |
| Pig | √ | √ | x |
| Chicken | √ | √ | x |
| Tangerine | √ | √ | x |
| Goat | √ | √ | x |
| Peanuts | √ | √ | x |

Some local potential agriculture products are in high demand, while others lack of market opportunities. For example, cattle (bovine meat) – the demand for Dili market is high, estimated around 800 tons of bovine meat per year (Scott et al. 2016). This is supported by a study done by Serrao et al (2010) which reveal that Dili has the largest local demand for beef, while Indonesia is the largest destination of beef exports from Timor-Leste. So far, the supply of cattle still not fulfil the demand mentioned.

In addition, there are potential market opportunities offered by Indonesian market for products like mungbean and cattle. For example, the demand for mungbean in Indonesia is around 50 000 tons per year - and Timor-Leste can only produce around 5 000 tons annually. Thus, for cattle, the demand for Indonesia market is also high. To fulfil the demand, Indonesia generally imported cattle from Australia. Timor-Leste geographically very close to Indonesia and this is an opportunity for private sector to more engage in cattle production for export. Indeed, in the past Timor-Leste experienced export cattle to Indonesia but it was stop in 2010. Since then no more export of cattle from Timor-Leste to Indonesia.

**Value added product -** the study reveal that the majority of producers (88.92%) did not performed value added for the product before distributed to the market. There is only 11.08 per cent conducted value added for some local potential products. The reason for not performing value addition for the product is due to 1) producers do not know how to value add the products 2) lack of knowledge and skills 3) lack of training on how to conduct value added activities and 4) lack of information on the importance of value added 5) there are no price differences between value added products and primary products 6) lack of buyer for value added products 7) most buyers prefer to buy primary product 8) lack of labor and capital 9) time constraints. The study reveal that

the main reasons for those who perform value addition activities is because it could improve the value and better price for the product and also diversifying the product to access better market. Local potential agriculture products that go through value addition are paddy rice, maize, cassava, sweet potato, coffee, candlenut, coconut and clove.

A discussion with coconut producer in Viqueque reveals that it is important to value-add the product because the market is needed (e.g., copra). Indeed, the price offered is quite low – but at least there is a local buyer that regularly purchases the product; this provides significant income for producers in rural areas. The study also reveal that coconut is the product that can be transform to a number of new product such as VCO, Copra, Soap and others. A site visits to a processing center for Virgin Coconut Oil in Souro – Lautem reveal that by transforming coconut into VCO it can offer significant revenue to people engage in the business. Despite this, there are a number of small businesses operated in transforming coconut into soap and also some business engages in copra processing in Lautem, Viqueque and Baucau.

**Grading -** There are more than 55 per cent of stakeholders interviewed saying that producers usually perform grading for the potential products before sell it to market. The type of grading activities conducted is very basic which includes the size of the product, maturity and cleanness. Indeed, the price for graded products are little bit better compared to those products that is not graded. Grading activities mostly conducted for potential products which includes banana, maize, coconut, tangerine, candlenut, shallot, vegetable products and cassava. In addition, it is around 40.10 percent of stakeholder's reveal that some producers are not grading their produce, and this is due to the lack of labor, lack of buyers, low prices and lack of knowledge and skills.

Cattle appear to be an attractive development activity in a number of municipalities including RAEOA, Manufahi, Viqueque, Bobonaro, Lautem and Covalima. Cattle are raised by a large number of households and make up a significant proportion of household income. There are established cattle and beef markets, both domestic and export in these areas. Census data of 2015 shows that livestock is clearly an important economic activity in these areas (DGE 2015). Through a deep interview with cattle traders in RAEOA, Manufahi and Covalima shows that the trading system for cattle is as follows: 1) The trading based around fattening households 2) They buy cattle for feeding – for variable periods 3) Indonesian traders can inspect and negotiate 4) Fattening households or a limited number of RAEOA, Manufahi and Covalima traders transport cattle to border and 5) Transaction and payment occurs at border.

In addition, most cattle from Timor-Leste are distributed through Wini, Atambua, Kefamenanu and Kupang. The details of the flows of cattle from RAEOA and Covalima to Indonesia are presented in the diagram below.

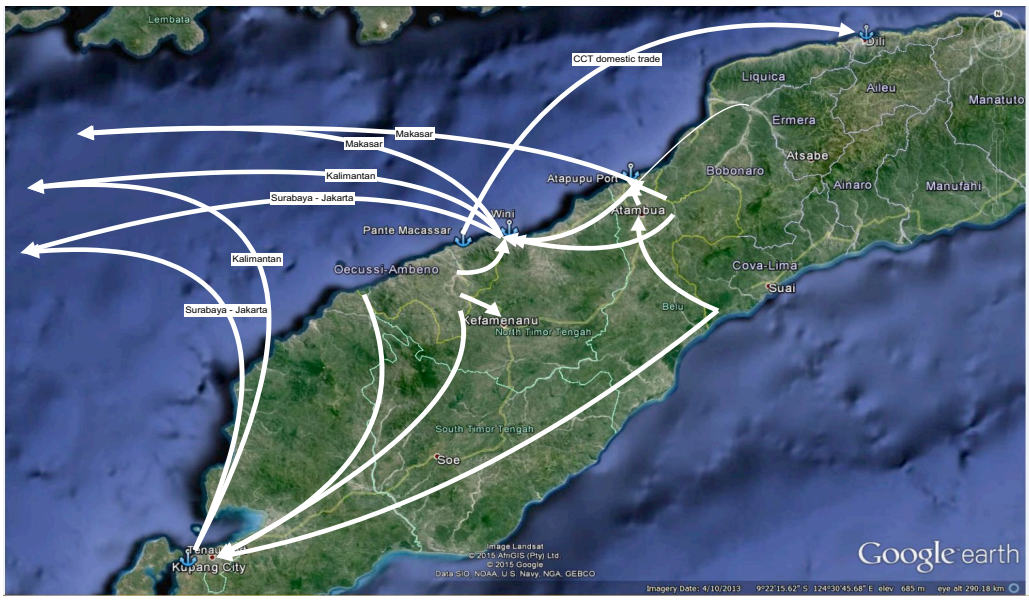



Figure 29. Broad cattle flows from RAEOA and Covalima to West Timor Indonesia
Adopted from: Waldron et al. 2015

If household in RAEOA and Covalima supply an average of two head cattle for the trade per year, then the total supply will be around 26 200 head/year (RAEOA 12 300 and Covalima 13 900 head). If this supply will be traded through the border with an average live weight of 275 kilograms, and average price of $2.70/kg, then it will generate revenue of about $21.2 million. If Timor-Leste charges an export duty of 5%/head, then this equates to about $131 000 in government revenue.

## IX. CONSTRAINTS AND OPPORTUNITIES FOR DEVELOPMENT OF MARKET CHAINS FOR AGRICULTURE AND LIVESTOCK PRODUCES IN TIMOR-LESTE

For Timorese smallholder farmers to become more involved in high value market and export-oriented crop and livestock production, they need to be equipped with complete market information, access to credit and training, particularly in production and marketing. Linking farmers closely to consumers provides new market opportunities, which can lead to fulfilling consumer preferences for quality, quantity and food safety.

### Constraints

The study reveals that the main constraints faced by producers and chain players in Timor-Leste in the development of market chain for local potential agriculture product and livestock are:

***Low production and productivity*** - Low production and productivity are challenges that generally emerged from the response of stakeholders. This is caused by low levels of input use, lack of skills, lack of capital and lack of information. A study conducted by Rola-Rubzen et al. (2010) in Timor-Leste found that one of the main reasons for the poor productivity is the low levels of input use in the farm. To increase crop productivity, inputs such as seeds, fertilizers and chemicals are needed.

***Lack of access to market*** – Lack of access to market is one of the major constraints faced by producers and chain players in Timor-Leste. Lack of well-functioning agricultural marketing system in this country resulted in producers having difficulties in marketing their surpluses. These constraints contributed to the low productivity of the products and access to market for small producers.

***Low skills and poor management*** - As the demand for some products increases both in domestic and regional markets, there is a need to increase the production and productivity of agricultural crops. However, the low level of skill of most producers impacted their ability to increase production to supply the market. Even though producers have long time experience in their farm, they continue to practice traditional ways of crop management. Producing and marketing of agricultural products to high-end markets require skills, which small farmers might not have.

***Lack of Financial support -*** One of the stumbling blocks for Timorese producers is the lack of capital to purchase inputs and invest in the improvements in the farm. With the lack of cash to purchase inputs and the lack of access to credit, it is difficult if not impossible for producers to increase production and productivity of their crops.

***Low output prices*** - Limited number of buyers appears to negatively impact the price offered to producers due to the power imbalance. There is lack of competition amongst buyers and as producers have no alternative market, they often accept whatever price is offered to them, whatever low that may be. Buyers are often able to manipulate the price. To address this problem, more investment on infrastructure is needed so more buyers can operate in the markets and farmers will also have more access to other markets. This will encourage competition and will benefit farmers in terms of getting a better deal on prices for their produce.

***Poor quality product*** – As most Timorese producers lack of skills both in production and marketing, lack of financial support and lack of market information therefore it affects the quality of the product produced. Most of the local potential agriculture products in Timor-Leste are in low quality. This further resulted to the price offered. To improve the quality of the product, private and public sector investment in terms of training, access to credit, and information and communication need to be taken into consideration.

***Low Input Use*** - One of the main reasons for the poor productivity is the low level of input use by producers in the farm. There is little input use by producers apart from seeds and labor. Very few farmers apply fertilizers and pesticides. This in turn is due to the low levels of income and low purchasing power of farm households. Most producers still rely on traditional seeds. To increase crop productivity, inputs such as seeds, fertilizers and chemicals are needed.

***Other constraints*** – are including Lack of labor, economic of scale, inconsistency of government policies, lack of involvement of private sector, and high marketing cost.

## Opportunities

Despite the constraints faced, there are opportunities for the development of market chain for local potential agriculture product and livestock in Timor-Leste. These opportunities are:

- ***Opportunities to increase production for local potential products*** – The productivity of most of local potential agriculture products in Timor-Leste are quite low. There is an opportunity to increase production and productivity through improve farm management, open-up more potential land for cultivation, apply Good Agriculture Practices (GAP) in managing the farm and apply regular inputs (e.g., seeds, fertilizer, chemicals, others). To do this the role of public and private sector is needed.
- ***High demand for cattle (bovine meat)*** – According to the Kementrian Pertanian Indonesia (2017) the development of consumer price of bovine meat in Indonesia tends to increase every year. This resulted from the demand for beef that is high. The demand of bovine meat in Indonesia in 2017 reach 168,558 ton and the importation for cattle for Java Island alone is around 298,000 head in 2018 (demand for cattle 6-7%/year). This provides an opportunity for private sector to invest in cattle production and for Government to rethink again for open-up cattle export to Indonesia. In addition, Dili alone need around 800 tons of bovine meat per year (Scott et al. 2015).
- ***Maximization of the use of land for cultivation*** – Most of the potential areas in Timor-Leste has not fully developed for local potential agriculture products. The reason is that smallholder producers in this country lack of capital, labor and skill to maximize the use of their land for cultivation. This is an opportunity where government and private sector need to intervene in terms of maximization of the use of land for agricultural production (e.g., through contract farming, etc.).
- ***Opportunities for processing vanilla*** – Value adding vanilla product from wet to dry vanilla will improve the value of the product. As a comparison the average price for one kilogram wet vanilla is US$45 while for the same weight for dry vanilla cost around US$400 (2019 price). Processing of vanilla before selling to the market is really important as this can improve significant revenue for vanilla producers. Therefore, opportunities to invest in processing of vanilla are needed. This can be done through improving the skills of vanilla producers in terms of how to value add vanilla product according to demand of the market or investing on applicable technology that can process vanilla product with good quality standard.
- ***Investing on export products*** (e.g., clove/pepper, etc.) – as some of the areas that is very potential for clove and pepper production therefore, investing more on these products are necessary to improve revenue for the country. Aileu for example is one of the municipalities that so far produce clove and pepper for export – however, the volume of export is small; and this is due to the area of production, which is small. By open-up more potential land for clove and pepper production it will increase the quantity of export annually.
- ***Opportunities for industry processing*** – there are some products (e.g., banana) that produced by farmers along southern coast of the country, from Viqueque, Natarbora and Manufahi throughout most of year. However, so far the product can

only be sold as primary product. To add value and looking for future market opportunity of this product, investing in processing of banana is necessary – as this can transform into banana juice, chips and other. By investing in the area of processing it will also offer jobs and income to people living in the southern coast.

- ***Improve quality of domestic rice*** – Most rice produce in these areas is in poor quality compared to the imported rice. However, the price is higher than the imported one – therefore consumers are preferred to buy imported rice. To compete with imported rice, it is important to improve the quality of domestic rice. To do this, private sector involvement is needed. Private sector intervention can be done through investing in the production and processing side. For government, it needs to play their role in terms of legislation and creating an enable environment for individual or companies to invest in the sector. By investing in improving the quality of domestic rice it will favor domestic consumers and in the same time reducing imported rice. This will result not only in terms of production and quality domestic rice but also it has a further impact on income, food security, jobs and poverty reduction.

- ***Value added product*** – One way to improve the value of the product is through the transformation of primary product to another product (e.g., coconut to VCO). Industrial crops such as coconut and candlenut are quite potential in Viqueque and Lautem. However, there are not many activities on the adding value of these products. Indeed, the demand for value added products for export (e.g., copra, VCO, cracked candlenut) is promising. This provides an opportunity for businesses to invest in processing (value add) of these products. This can be done through training to improve the skills of producers, provide technical assistance and financial support or investing on applicable technology that can help the processing of the product so that it will produce add value product with good quality standard.

## X. CONCLUSION AND RECOMMENDATION

### 10.1 Conclusion

To accelerate economic growth in all municipalities in Timor-Leste there is a need to modernize agricultural production, requiring markets for both inputs supply and for the sale of output products. The strengthening of the existing markets and development of new markets can be done through the improvement in infrastructure, improvement in access to information, reduction in transaction costs and promoting competition.

The government of Timor-Leste is committed to develop a non-oil economy through the diversification of domestic trade in particular agricultural sector. This can be seen through the total investment in this sector from 2008-2016 of $218.4 million dollars. In addition, this sector has the greatest potential to expand export and this will positively have impacted to the reducing of poverty and unemployment in the country.

The result of the study revealed there are 23 local potential agriculture products and livestock in in Timor-Leste. These potential products are Cattle, Rice, Maize, Mungbean, Peanuts, Pig, Tomato, Sweet Potato, Cassava, Chicken, Goat, Vanilla, Clove, Tangerine, Banana, Shallot, cabbage, Carrots, Coffee, Red bean, Coconut, Candlenut, and Mungbean.

Based on the review of literature and interviews with stakeholders it shows that these products have the potential for export and also the demand in domestic market is high. These products also involve a large number of households in the production side and this means local potential products provide more job opportunities for communities in rural areas, which in turn contributed to the income earned by rural families.

The production and productivity of local potential products in Timor-Leste are very low. The productivity of coffee for example is still less than one tone per hectare and tangerine only three tons per hectare. These yields are still far for the potential production that these crops can achieved. This is due to the poor farm management, lack of input supply and extensive use of local seeds variety seeds.

In terms of the demand, most of the local potential products and livestock are in high demand in domestic and international market. Cattle (bovine meat) are in high demand for domestic and Indonesian market, while coffee (organic) and clove is also having a good demand for foreign market. The main issue faced is there is lack of supply to meet the demand of the market.

To develop these potential products in Timor-Leste, the presence and support from private and public sector is needed. Despite the constraints facing such as low productivity and low quality products however, there are opportunities for further improvement for local potential products. These includes opportunity to increase production and productivity, improve more value addition products, opportunity to invest in cattle production, and finally opportunity to invest in rice sector so that the quality of local rice can be improved and this will have resulted in the reduction of rice import into the country. Furthermore, the new products, which have high value such as Konjak, Vanilla, Rambutan and others, need to take into consideration for further development in Timor-Leste.

## 10.2 Recommendation

The result of the study clearly demonstrates that there is a potential to develop local potential agriculture products and livestock in Timor-Leste. However, issues such as lack of inputs, low price for the produce, low quality and low skills of farmers hindering the opportunity to develop these products in an effective and efficient way. In relation to these issues, it is recommended:

**To Government of Timor-Leste**

- Supporting farmers to transition subsistence farming to a market oriented agriculture by providing more quality seeds, replanting of industrial crops such as coconut, providing advanced farming technology, improving value added products) (Ministry of Agriculture, Ministry of Commerce and Industry);
- Providing support and assistance in a sustainable manner to producers and chain players engaging in the distribution of local products to market (Ministry of Commerce and Industry, Ministry of Agriculture);
- Providing capacity building to all chain players to ensure the efficiency and effectiveness of the supply chain in terms of training, market awareness and education (Ministry of Commerce and Industry, IADE);
- Motivating producers with necessary incentives or motivation to produce local potential agriculture products with good quality (Ministry of Commerce and Industry, Ministry of Agriculture, TradeInvest);
- Providing support to agribusiness firms in terms of technical and financial support for the development of value added activities and link producers to market activities (Ministry of Agriculture, Ministry of Commerce and Industry, TradeInvest);
- Re-opening of export market (cattle) with Indonesia as soon as possible (Ministry of Commerce and Industry);
- Providing and monitoring regular information on prices not only for local potential products but also for agricultural products in general. This is important as this can be used as basis for bargaining with buyers for a better deal in particular in local markets in rural areas (Ministry of Commerce and Industry);
- The existing market for these potential products is operated well however, it needs further improvement so that it can facilitate the movement of the products from remote areas to the market more easily. This can only be done through the improvement in infrastructure, improvement in access to information, reduction in transaction costs and promoting competition (Ministry of Commerce and Industry);
- Improving business environment to enable private sector investing and developing in agriculture sector (Coordinating Minister for Economic Affairs, TradeInvest);
- Attracting more investments with export orientation in agriculture industry should be encouraged in order to contribute to employment generation (TradeInvest);
- In responding to current Global Pandemic COVID-19, the Government needs to take this opportunity to focus on a strategic plan by integrating agriculture sector into economic recovery plan (Coordinating Minister for Economic Affairs).

**Private Sector**

- Investing in more value-adding and marketing activities for local potential agriculture products so that it can improve the value of the product (to be supported and facilitated by Ministry of Commerce and Industry, Ministry of Agriculture and TradeInvest);
- As most producers still depend on local seed which can affect low productivity, therefore more support on input supply in terms of making inputs available locally is needed;
- Introducing high yield varieties for local potential agriculture products and livestock;

**International Agencies (AVANSA Agricultura, MDF, CRS, JICA)**

- Providing more technical assistance on the production and marketing especially to farmers and cooperative groups in horticulture sector;
- Improving the skills of producers and chain players through capacity building;
- Considering to provide more support (technical assistance) to potential agriculture location in South Municipalities such as in Same, Ainaro to support rural development

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## APPENDIX

Appendix 1. National production information of rice subsector in Timor-Leste

| | Annual production (t/year) | Cultivated area (ha) | Average yield (t/ha) |
|---|---|---|---|
| Rice (averages for the period 2006-2015) | 50,000 | 27 780 | 1.8 |
| Average annual growth over the last 10 years (%) | 2.4 | | |
| Average cost of production (USD/ton) | 190 | | |
| | On farm consumption | Marketed | |
| Percentage of production (%) | 85 | 15 | |
| | Volume (ton/year) | Value (USD/year) | |
| Market product #1, rice | 7,500 | 4.95 million | |
| | Small | Medium | Large |
| Level of processing operation | ✓ | ✓ | - |
| Level of trading/wholesale operation | ✓ | - | - |
| Level of retail operation | ✓ | - | - |

*Source: Young 2013; Correia et al. 2016*

Appendix 2. Formal cattle and Buffalo exports 2005-10.

| | Cattle (head) | Buffalo (head) | Hides (pieces) |
|---|---|---|---|
| 2005 | 2,913 | 99 | |
| 2006 | 2,473 | 151 | |
| 2007 | 2,022 | 410 | |
| 2008 | 1,201 | 260 | 400 |
| 2009 | 910 | 76 | 4,872 |

*Source MAFF, 2010*

Appendix 3. Area, Production, Producers and potential areas of coffee in Timor-Leste (2015)

| Municipio | Area (ha) | | Production (ton) | No of producers | Potential area (ha) |
|---|---|---|---|---|---|
| | Productive | Non-productive | | | |
| Ermera | 20,800 | 11,200 | 5360 | 27,210 | 1945 |
| Manufahi | 4163.25 | 2241.75 | 3560 | 12,420 | 1450 |
| Liquica | 7777.25 | 4187.7 | 4050 | 7232 | 1448 |
| Ainaro | 3417.3 | 2278.2 | 2540 | 6450 | 1240 |
| Aileu | 1152 | 620 | 1040 | 1430 | 2730 |
| Bobonaro | 563 | 406 | 950 | 1027 | 1490 |
| Covalima | 18 | 12 | 460 | 41 | 1250 |
| Manatuto | 227.5 | 72.5 | 450 | N/A | N/A |
| Viqueque | N/A | N/A | N/A | N/A | N/A |
| Baucau | 2 | 1 | 0.002 | 2 | 100 |
| Lautem | 12.9 | 88 | 0.005 | 10 | 100.9 |
| Oecusse | 2 | 3 | 0.002 | 5 | 100 |
| Total | 37,908 | 21,038 | 17,960 | 55,827 | 11,853.9 |

*Source: Direção Nacional do Café e Plantas Industrias – MAP 2015*

Appendix 4. Potential areas for Tangerine and Banana in Timor-Leste from 2012-2013

| Municipio | Tangerine | | | | | | Banana | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | | | 2013 | | | 2012 | | | 2013 | | |
| | Area planted (ha) | Yield (ton/ha) | Total production (ton) | Area planted (ha) | Yield (ton/ha) | Total production (ton) | Area planted (ha) | Yield (ton/ha) | Total production (ton) | Area planted (ha) | Yield (ton/ha) | Total production (ton) |
| Aileu | 24.37 | 22 | 536.14 | 25.59 | 10 | 255.90 | 6.00 | 4 | 24.00 | 7.50 | 10 | 75.00 |
| Ainaro | 23.05 | 18 | 414.90 | 24.20 | 10 | 242.00 | 7.00 | 6 | 42.00 | 8.75 | 10 | 87.50 |
| Baucau | 19.28 | 15 | 289.20 | 20.24 | 9 | 182.16 | 135.77 | 16 | 2172.32 | 135.77 | 11 | 1493.47 |
| Bobonaro | 12.24 | 14 | 171.36 | 12.85 | 9 | 115.65 | 4.16 | 12 | 49.92 | 12.00 | 10 | 120.00 |
| Covalima | 4.16 | 15 | 62.40 | 4.37 | 8 | 34.96 | 4.00 | 10 | 40.00 | 15.25 | 10 | 152.50 |
| Dili | 52.02 | 10 | 520.20 | 13.01 | 10 | 130.10 | 5.20 | 9 | 46.82 | 4.94 | 9 | 44.46 |
| Ermera | 24.07 | 21 | 505.47 | 25.27 | 10 | 252.70 | 6.00 | 8 | 48.00 | 12.00 | 8 | 96.00 |
| Liquica | 25.09 | 22 | 551.98 | 26.52 | 11 | 291.72 | 0.40 | 9 | 3.60 | 5.50 | 9 | 49.50 |
| Lautem | 26.01 | 10 | 260.10 | 27.31 | 10 | 273.10 | 6.24 | 10 | 62.40 | 25.75 | 10 | 257.50 |
| Manatuto | 8.67 | 12 | 104.04 | 9.10 | 10 | 91.00 | 3.12 | 17 | 53.04 | 25.85 | 10 | 258.50 |
| Manufahi | 8.36 | 15 | 125.40 | 8.78 | 10 | 87.80 | 4.00 | 14 | 56.00 | 27.50 | 11 | 302.50 |
| Oecusse | 15.60 | 12 | 187.20 | 16.38 | 9 | 147.42 | 0 | 11 | 0 | 4.50 | 9 | 40.50 |
| Viqueque | 8.77 | 12 | 105.24 | 9.21 | 12 | 110.52 | 5.72 | 19 | 108.72 | 12.50 | 10 | 125.00 |
| Total | 251.69 | | 3833.63 | 222.83 | | 2215.03 | 187.61 | | 2706.82 | 297.81 | | 3102.43 |
| Average | | 15.23 | | | 9.85 | | | 11.15 | | | 9.77 | |

*Source: Direcao Nacional da Agricultura e Horticultura – MAP 2014*

Appendix 5. Candlenut Production by municipality in Timor-Leste

| Municipality | Production area (ha) | % of total area |
|---|---|---|
| Baucau | 933 | 32 |
| Viqueque | 629 | 21 |
| Ainaro | 320 | 11 |
| Lautem | 307 | 10 |
| Bobonaro | 307 | 10 |
| Oecusse | 138 | 5 |
| Manufahi | 109 | 4 |
| Covalima | 94 | 3 |
| Manatuto | 92 | 3 |
| Liquica | 10 | <1 |
| Aileu | 5 | <1 |
| Dili | 2 | <1 |
| Eremra | 1 | <1 |
| TOTAL | 2,947 | 100% |

*Source: National Directorate of Coffe & Industrial Plants – MAF 2015*

Appendix 6. Production and yield of *Paddy rice* in the municipality of Viqueque 2019

| Posto Administrativo | Potential area (ha) | Planted area (ha) | Harvested area (ha) | Yield (t/ha) | Production (t) |
|---|---|---|---|---|---|
| Lacluta | 845 | 11.60 | 11.60 | 3.09 | 35.80 |
| Ossu | 791 | 20.02 | 20.02 | 3.01 | 60.22 |
| Uatucarbau | 1,960 | 1,388.25 | 1,388.25 | 5.94 | 8,248 |
| Uatolari | 3,455 | 1,743.15 | 1,743.15 | 4.85 | 8,452.86 |
| Viqueque Villa | 2,742 | 824.90 | 824.90 | 2.80 | 2,310.93 |
| Total | 9,793 | 3,987.92 | 3,987.92 | 3.94 | 19,107.81 |

*Source: MAP Municipio Viqueque 2019*

Appendix 7. Production and yield of *Maize and paddy rice* in the municipality of Bobonaro

| | Maize | | | | Paddy rice | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Area planted (ha) | Area harvested (ha) | Yield (ton/ha) | Production (ton) | Area planted (ha) | Area harvested (ha) | Yield (ton/ha) | Production (ton) |
| 2016 | 3352.5 | 3155.1 | 2.27 | 12,804.45 | 866.40 | 866.40 | 2.49 | 2155.50 |
| 2017 | 2599.6 | 2599.6 | 2.35 | 6109.34 | 2132.70 | 2132.70 | 3.28 | 6974.19 |
| 2018 | 9036.0 | 8357.1 | 2.36 | 19,793.01 | 3148 | 3148 | 3.60 | 11,395 |
| 2019 | 6507 | 6500 | 3.80 | 24,575 | 3503 | 3500 | 3.60 | 12,641 |

*Source: Direção Serviço Agricultura Município Bobonaro - 2019*

Appendix 8. List of the name of enumerators participated in this study

| Name | Institution |
|---|---|
| Almerinda M. Sarmento | Agriculture Faculty-UNTL |
| Ana Paula da Silva | Agriculture Faculty-UNTL |
| Matilda Gabriela | Agriculture Faculty-UNTL |
| Alcina Maria Tilman | Agriculture Faculty-UNTL |
| Samuel cabral | Agriculture Faculty-UNTL |
| Izidoro C. Ximenes | Agriculture Faculty-UNTL |
| Walter O. Soares | Agriculture Faculty-UNTL |
| Jose da Silva | Agriculture Faculty-UNTL |
| Lovito Soares | Agriculture Faculty-UNTL |
| Julito F.dos Santos | Agriculture Faculty-UNTL |
| Jose C.B.Borromeo | Agriculture Faculty-UNTL |
| Januario da S.Belo | Agriculture Faculty-UNTL |
| Baltazar E.D.C. Soares | Agriculture Faculty-UNTL |
| Delfim da Costa | Agriculture Faculty-UNTL |
| Maria Rosentina | Agriculture Faculty-UNTL |
| Jorge dos Santos | Agriculture Faculty-UNTL |
| William O.X.Sozinho | Agriculture Faculty-UNTL |
| Ilizeu Pereira | Agriculture Faculty-UNTL |
| Abril M.Soares | Agriculture Faculty-UNTL |
| Evalina Saldanha | Agriculture Faculty-UNTL |

*# Final year students at the Faculty of Agriculture UNTL*

Appendix 9. List of stakeholders consulted

| No | Stakeholder name | Title / position | Institution | Telp |
|---|---|---|---|---|
| 1 | Quintino Gusmao | Cordenator Geral Extensionista Covalima | MAP Covalima | 77359517 |
| 2 | Graciano Amaral | Cordenador Extensionista Maucatar | MAP Covalima | 77476888 |
| 3 | Marcelino Cardoso | Cordenador Extensionista Fatumean | MAP Covalima | 76470766 |
| 4 | Jaime S.pereira | Cordenador Extensionista Suai | MAP Covalima | 76530713 |
| 5 | Paulo da Costa | Cordenador Extensionista Fatululik | MAP Covalima | 77477733 |
| 6 | Angelino Amaral | Vice Cordenador Extensionista Jumalae | MAP Covalima | 75894250 |
| 7 | Angelina S.Barros | Staf tecnico diresaun Crops | MAP Covalima | 77340500 |
| 8 | Urbanu M.T.Suri | Chefe Dep. Pecuaria e Veterinaria | MAP Covalima | 77312864 |
| 9 | Jose Fatima Xavier | Administrador Posto | Tilomar | 77304183 |
| 10 | Santiago Barreto | Administrador Posto | Jumalae | 77304185 |
| 11 | Rosalina Martins | Diretor Manager Program | OXFAM | 77310889 |
| 12 | Mateus C.Araujo | Ass Cordenador Micro Pequena empresas | MCIA Covalima | - |
| 13 | Inacia Teixeira | Secretario Regional de Tourismo RAEOA | RAEOA | 77340023 |
| 14 | Elias Silva | Centro Edukasaun Civica | Local NGO-RAEOA | |
| 15 | Armindo R.Santos | Program Manager | OXFAM-RAEOA | 77284589 |
| 16 | Deolindo Sequeira | Cordenador | CCT-RAEOA | |
| 17 | Raimundo COA | Cordenador | Local NGO-AHCAE | 75222200 |
| 18 | Lawrance | Trader | Private sector | 75375613 |
| 19 | Alberto P.Nino | Administrador Posto | Oesilo | 77304424 |
| 20 | Antao Ulan | Administrador Posto | Passabe | 78997615 |
| 21 | Jacinto C. | Butcher | Local business | 75949845 |
| 22 | Benjamin Elo | Cattle trader | Private sector | |
| 23 | Higino | Diretor | Comp. ACELDA | |
| 24 | Insencinio A.da Silva | Cordenador Extensionista | MAP Baucau | 77247446 |
| 25 | Januario Pereira | Cordenador MCIA região I | MCIA Baucau | 77278866 |
| 26 | Jose M.Alves | Crop Manager | CRS Baucau | 77325044 |
| 27 | Jumilda M. Vilanova | Program manager | World Vision | 77281500 |
| 28 | Isac | Program manager | TOMAK Baucau | |
| 29 | Sebastiao Correia | Administrador Posto | Vemasse | 77304120 |
| 30 | Aderito Santos | Director | MAP Maliana | 77187900 |
| 31 | Jose de Deus | Director | MAP Ermera | 77806550 |
| 32 | Alberto G.Lopes | Coordinator | CAAKUB Maliana | 77029966 |
| 33 | Lucio da Costa | Staff | JICA Maliana | 77025881 |
| 34 | Mateus Rosario | Manager | WV-Maliana | 77293663 |
| 35 | Rince Nipu | Director | Local NGO OHM | 77615050 |
| 36 | Martins Magno | Director | MCIA Maliana | 77087440 |
| 37 | Tomas Barreto | Adjunto Adm Posto | Bobonaro | 77304123 |
| 38 | Egidio Loisiga | Adjunto Adm Posto | Maliana Vila | 78123276 |
| 39 | Olandina M.Leite | Manager | TOMAK Maliana | 78065004 |
| 40 | Rui | Agribusiness Staff | MAP Maliana | |
| 41 | Antonio M. Lay | Extension Coordinator | MAP Maliana | 77296508 |
| 42 | Adao Pirez | Adjunto Adm Posto | Atabae | 76521181 |
| 43 | Luis Mira | Manager | Avanza Maliana | |
| 44 | Moises Borromeu | Vice Rector I | ETCI | 78536231 |
| 45 | Augusto | Manager | Avanza Ermera | 78154725 |
| 46 | Arlindo dos Santos | Director | IMI | 77304194 |
| 47 | Luis P.do Carmo | Adjunto Adm Posto | Letefoho | 77443610 |
| 48 | Celestino M. | Head Farmer group | Vanilla farmer Hatulia | 76160159 |
| 49 | Agostinho A.de Deus | Field staff | Peace Wing Letefoho | |
| 50 | Antonio Babo | Coordinator | Coop. Ermera | 76685384 |
| 51 | Fernando Soares | Administrador | P.A.Ermera Villa | |

| | | | | |
|---|---|---|---|---|
| 52 | Salvador S. Santos | Director | MCIA Liquica | 77087443 |
| 53 | Mario da Silva | Diretor | MAP Liquica | 78065031 |
| 54 | Vitor Soares | Extension coordinator | MAP Liquica | 77451679 |
| 55 | Manuel A. Ramos | Head of Village | Vatuboro | 75270736 |
| 56 | Joao N.Braz | Administrador | P.A. Bazartete | 77304211 |
| 57 | Martinho dos Santos | Head Farmer group | Fahilehu | 77380082 |
| 58 | Jose H. Afonso | Manggis farmer | Ald. Tolido Kraik | |
| 59 | Manuel A. Ramos | Banana farmers | Suco Lisadila | 75270736 |
| 60 | Eng. Subady | Coffee expert | CCT railaco | 77017894 |
| 61 | Antonio Babo | Staff | MCIA Ermera | 76685384 |
| 62 | Julio dos Reis | Director | IADE Ermera | |
| 63 | Edmundo da Costa | Director | MAP Lautem | 78065037 |
| 64 | Raimundo da Cruz | Head of Industrial plant | MAP Lautem | 77376943 |
| 65 | Francisco J. Monteiro | Administrator | P.A. Lautem | |
| 66 | Venancio Ximenes | Coordinator Extension | MAP Lautem | 78065032 |
| 67 | Zito Guimaraes | Head of Livestock | MAP Lautem | |
| 68 | Elizito J.Ximenes | Head of Fisheries | MAP Lautem | 77258249 |
| 69 | Tito Batista | Agribusiness staff | MAP Lautem | 76130950 |
| 70 | Cancio Miranda | Wholesaler (Copra and Candlenut) | Private business | 75235064 |
| 71 | Bruno Amaral | Project Coordinator | GIZ Lautem | 77376085 |
| 72 | Arsenio M.Costa | CDO | P.A. Lospalos | 77347983 |
| 73 | Basilio da Costa | Project Coordinator | NGO Fraterna | 75055535 |
| 74 | Lucio de Oliveira | Coordinator | CCT Losplaos | |
| 75 | Carolino dos Santos | Coordinator | Coop. Fini Losp. | 77673310 |
| 76 | | Administrador | Mun. Viqueque | |
| 77 | Manuel Ximenes | Project Coordinator | ADRA-Int NGO | 77403236 |
| 78 | Bonifacio Amaral | Coordinator Extension | MAP Viqueque | |
| 79 | Aniceto Gusmao | Extension worker | MAP Viqueque | 77477442 |
| 80 | Fernando | Head of Fisheries | MAP Viqueque | 74005697 |
| 81 | Raimundo C.Freitas | Vocal Point MCIA | MCIA Viqueque | 77322434 |
| 82 | Bendito Amaral M. | Project Manager | TOMAK | |
| 83 | Joao Lemos | CDO | P.A. Uatulari | 78418223 |
| 84 | Firmino da Costa | MAP officer | MAP Manatuto | 77270503 |
| 85 | Edalina da Costa | Chief of Admministration | P.A. Manatuto | 77410830 |
| 86 | Duarte da Costa | Head of Environmental | MCIA Manatuto | 77328170 |
| 87 | Chiquita da Silva | Agriculture Coordinator | NGO-Moris Foun | 77379141 |
| 88 | Fernando Valentin | CDO | P.A. Laclubar | 76265804 |
| 89 | Venancio C.Ximenes | CDO | P.A. Barique | 77313030 |
| 90 | Alarico Moniz | Vice Director | SPP Natarbora | 75633066 |
| 91 | Joao T.Rego | Administrador Municipio | Municipio Aileu | 77311652 |
| 92 | Marcos dos Santos | Administrador Posto | P.A. Aileu Vila | 77304106 |
| 93 | Diretor MAP-Aileu | Diretor | MAP Aileu | |
| 94 | Laurentino C. Goveia | Diretor | MTCI Aileu | 77727691 |
| 95 | Lurdes M.Ramos- | Responsavel | Coop. HICMOR | |
| 96 | Emelita da Cruz | Coordinator | WV- Aileu | 77283391 |
| 97 | Mafalda dos Santos- | Responsavel | Comp. CNF | |
| 98 | Jose Rangel | Coordinator | AVANZA | 77425816 |
| 99 | Jacinto Vilanova | Administrador Posto | P.A. Lekidoe | 77304190 |
| 100 | Carlos de Araujo | Lead Farmer | Suco Seloi Kraik | 77665153 |
| 101 | Tobias dos Santos | Extensionista | MAP Laulara | |
| 102 | Maria de Fatima | Group leader | Suco Saboria | 77662476 |
| 103 | Amelia Soares | Trader | Private sector | |
| 104 | Domingos Mesquita | Chefe Suco | Suco Lahae | 76792344 |
| 105 | Daniel Soares | Tangerine Farmer | Farmer Lekidoe | |

| | | | | |
|---|---|---|---|---|
| 106 | Duarte Vitor | Pepper Farmer-Laulara | Farmer-Laulara | |
| 107 | Filomeno Tilman | Chefe gabinete | Mun. Manufahi | 78449011 |
| 108 | Aurelio dos Santos | Diretor | MAP Manufahi | 78065035 |
| 109 | Francisco C.Soares | Lead Farmer | Banana farmer | 78460917 |
| 110 | Cipriano Tilman | Vice Rector I | IPB | |
| 111 | Armando da Silva | Coordinator | NGO Luta ba Futuru | 77711000 |
| 112 | Armindo A.da Costa | Administrador Posto | Posto Same Vila | 77304221 |
| 113 | Jose R.Lobato | Coordinator | CCT Same | 77559512 |
| 114 | Antonio M.Pereira | Coordinator Group | RK-Fatucahi | 77096697 |
| 115 | Natalia S. Noronha | Drietora Café Familia | Private sector | 75668372 |
| 116 | Gil T. Amaral | Administrador Posto | Posto Fatuberlihu | 77304219 |
| 117 | Jose dos Santos | Chefe Suco | Suco Rotutu | 78066862 |
| 118 | Adelino da Costa | Extensionista | MAP Manufahi | 77270391 |
| 119 | Alsino Sarmento | Extensionista | MAP Manufahi | 77696600 |
| 120 | Moises Cardoso | Farmer | Avocado farmer | 75736948 |
| 121 | Norberto C.Sequeira | Farmer | Vanilla farmer | 75975490 |
| 122 | Joniveva R.Martins | Director | Private sector | 75035810 |
| 123 | Coreno da Costa | Coordinator | EFOBOM | |
| 124 | Aguida J.Mendonca | Deputy Administrador | Municipio Ainaro | 77304100 |
| 125 | Lucio R.Ribeiro | Diretor | MAP Ainaro | 78065048 |
| 126 | Alda Barros | Collector - Vegetable | Ainaro Vila | 77790294 |
| 127 | Cristovinho V.Araujo | Coordinator | G. J. MAP Ainaro | 77929666 |
| 128 | Valente de Araujo | Farmer | Vanilla farmer | 76649787 |
| 129 | Carlos Doloroso | Farmer | Pineapple farmer | 77015551 |
| 130 | Zemribes D.Pereira | Responsavel | MTCI | 77074206 |
| 131 | Nazario de Araujo | Administrador Posto | Posto Ainaro Vila | 77734110 |
| 132 | Wilson M. Mendonca | Chefe Suco & collector | Suco Maubisse Vila | 77250001 |
| 133 | Henrique C.C.Nunes | Responsavel | PARCIC | 77355336 |
| 134 | Moises do Rego | Responsavel | CCT Maubisse | 77289593 |
| 135 | Manuel Mendonca | Collector - Cabbage | Posto Hatubuilico | 75702838 |
| 136 | Armando de Araujo | Administrador Posto | Posto Hatubuilico | 77304113 |
| 137 | Rafael Ximenes | Farmer | Cabbage farmer | 76652977 |