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Final report

Small research and development activity

project

Economic analysis of cattle fattening systems based on forage tree legume diets in Eastern Indonesia

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2 Executive summary

Research and government agencies in NTB and NTT provinces have identified two systems that have high potential to increase productivity and incomes in the cattle sector: improved cattle feeding practices through forage tree legumes (FTL, *sesbania* in Lombok and *leucaena* in Sumbawa and West Timor); and the development of more efficient and specialised cattle fattening systems. These are the focus of ACIAR project LPS/2008/054 "Improving smallholder cattle fattening systems based on forage tree legume diets in Eastern Indonesia and Northern Australia".

As LPS/2008/054 entered Phase 2 with a focus on assessing barriers to and drivers of adoption, ACIAR Impact Assessment 65 recommended that research be conducted on the "application and verification of economic models in the latter part of the project". This provided the rationale for this Small Research Activity LPS-2014-034. In the development of the research proposal, the scope of the research was widened to include value chain structures that might also act as drivers or barriers to adoption.

Thus, this SRA LPS-2014-034 aimed to assess the economic incentives for farmers to adopt and adapt FTL-based fattening systems in NTB and NTT; and examine agribusiness linkages to increase incomes and outreach for households engaged in FTL-based fattening. The project was conducted between July 2014 and March 2016, with a total budget of $89,435.

The methodologies used in the research include

- the development of an economic household model of the FTL-fattening systems
- the mapping and examination of cattle value chains in NTT and NTB
- Data was gathered through trials and expert advice from LPS/2008/054, and from fieldwork in West Timor, Lombok and Sumbawa in May 2014 and July 2015
- Case study analyses were conducted in three project sites in West Timor, Lombok and Nyerot
- The SRA was conducted as a partnership between researchers from the University of Queensland, BPTB NTT and BPTP NTB.

The outputs of the project are:

- A detailed (86 page) report on the "Economic analysis of cattle fattening systems based on forage tree legume diets in Eastern Indonesia".
    - This provides a grounded and rigorous assessment of the economic incentives for small-holders to adopt FTL-based fattening in a range of scenarios
    - Examines agribusiness linkages that offer potential to increase incomes, prices and outreach for households engaged in FTL-based fattening.
    - Examines change in macro-industry indicators in Indonesia, NTT and NTB.
- A detailed (5 sheet, >500 rows) economic model of FTL-fattening systems in NTB and NTT. The partial budget is written in Excel, is user-friendly and designed so that project partners and industry stakeholders can update and use the budget to simulate a wide range of scenarios.
- The economic model and the report will also be of benefit to stakeholders because it assembles, describes and contextualises information about all aspects of household FTL-fattening systems in NTT and NTB, in a different way to that reported elsewhere in LPS/2008/054.

The main findings of the project are as follows.

Household budgeting

- Under all measures of profitability, representative households in all sites are profitable in **wet season.** As could be expected, “return to person days” in **dry season** are lower than average off-farm wages.
- While cattle fattening is unlikely to make a household “rich” it generates cash income, increasingly required to pay for cash expenses in modern rural Indonesian society.
- These returns are far higher than fattening systems without leucaena/ sesbania (based on cut grass, residues and purchased feeds) which are unviable in any measure of profitability.
- Returns are (in order of importance) sensitive to **weight gains, input-output price alignments, capacity utilisation** and **capital costs.**

Macro settings

- Official statistics used to project cattle numbers in Indonesia (16 million head in 2013) were found to be lower in the 2013 agricultural census (12.6 million). The differentials were even greater (35%) in NTB (to reach 650,000 head), but minor in NTT (800,000 head).
- Cattle fattening households are integrated into both local slaughter and live export chains. NTT has traditionally exported roughly the same number of cattle that it slaughters, but quota limited exports to 55,000 slaughter cattle in 2015 (not accounting for significant informal exports). Because of the high demand for beef especially in Lombok, abattoirs in NTB slaughtered 75,000 head in 2013, while NTB exported only 20,000 slaughter cattle (almost all from Sumbawa), as well as 17,000 breeding females (mainly from Lombok).
- Beef prices increased rapidly, reached a peak in February 2013, but stablished over 2013-15. The price of beef in Jakarta is 11% higher than Mataram and 35% higher than Kupang, which explains the large inter-provincial cattle trade. The markets appear relatively well-integrated (move together). There is also significant seasonality and intra-year fluctuation in beef prices due to festivals and local conditions (season, weather for shipping, payment of school fees etc.).
- Buoyant markets benefit cow-calf producers most directly (and can increase short-term incentives to sell cows), but also fattening households insofar as they earn higher prices per kilogram gained over the fattening period. However, in competitive markets, prices of feeder cattle have also increased, sometimes (especially in Lombok) faster than finished cattle. Price alignments have a large impact on the profitability of fattening households.

Value chains

- The predominant spot marketing systems in NTT and NTB do not operate perfectly, but they are generally low cost and competitive, with high volume and penetration of information including to farm level. In this case, there are no major value chain initiatives that offer windfall gains. Other initiatives (such as direct selling to new abattoirs) entail a range of other challenges especially related to the cattle prices that the plants can afford to pay. Fattening households are best served by maintaining a range of marketing options and channels.
- In NTT and NTB, there are inefficiencies in the holding and quarantine of cattle for export (due to institutional settings). In NTT, structures and practices for live cattle export (quota allocation and concentrated power) are under review. Inefficiencies and uncompetitive markets result in costs that are passed back to producers in the form of lower prices.
- There appears to be scope to involve agribusiness in extension activities (e.g. field days, dissemination of research material) to take advantage of their large catchments

and networks. This is especially the case for large cattle marketing companies and exporters in NTT. However, there are limits in the incentives, interest or capacity of the companies to engage in large, in-depth, repetitive programs to deliver embedded services.

3 Achievements against project activities and objectives

Table 1 summarises the three *project objectives* set in Section 3.1 of the project proposal and the *achievements* in meeting the objectives. Project objectives were met and indeed exceeded the scope and depth of the research – with the exception that three sites were modelled rather than the planned four.

Table 1. Project objectives and achievements

No.	Project Objective	Achievements
1.	Conduct an economic analysis of FTL-based cattle fattening systems in NTB and NTT to: build confidence in the economic feasibility of FTL/fattening systems; assist in the targeting of project outreach activities; and provide tools for outreach and extension	Done and reported in Waldron et al. (2016). The analysis confirms that in current and foreseeable market conditions, for average and high-performing households, FTL-based fattening is an attractive rural activity and can stimulate local cattle industries. The detailed justification and calculations are set out in the report for interpretation and reporting by project partners for communication with stakeholders including households, agribusiness, extension staff and policy-makers. As far as we know, this is the most rigorous economic analysis conducted on household fattening in Eastern Indonesia, and the tools are publically and freely available.
2.	Conduct a value chain analysis of FTL-based cattle fattening systems in NTB and NTT to identify interventions and settings that constrain or drive uptake	Done and reported in Waldron et al. (2016). The analysis concludes that value chains are not a major constraint to uptake of FTL-based cattle fattening for households, who should maintain choice and flexibility in marketing channels and terms. However, some obvious (and well-known) chain inefficiencies have been documented. Projects have a role to play in building closer relations between households and buyers (especially exporters and abattoirs) in communicating cattle preferences and disseminating extension information through buyer networks.
3.	Develop farm budgets and training materials to facilitate uptake and extension of FTL-based cattle fattening systems in NTB and NTT. These will be developed with researchers in LPS/2008/054 for training of next-users (especially extension agents) and end-users (farmers, especially in cattle fattening)	Detailed and comprehensive budget templates (economic models) have been developed, calibrated for three project sites, and scenarios identified and run. This was done with project partners who requested: that the budget cover detailed items (e.g. kandang construction, use of manure and FTL timber); that particular scenarios of interest were run; and that the budget was easily understood and used. In this regard, the budget is set out clearly, contains explanatory notes on all line items and contains transparent formulas that enable application by partners and stakeholders

Table 2 lists five *project activities* set out in Section 3.2 of the project proposal and details on the *activities conducted* in the project.

Table 2. Project activities and achievements

No.	Project Activity	Output	Activities conducted
1.	Project design	a) Trip report b) Project proposal	Conducted and reported May 2014 (with LPS/2008/054) and reported, proposal submitted
2.	Budget templates for training	Budget templates developed for cattle fattening households in NTB and NTT	Detailed and comprehensive budget templates (economic models) developed, calibrated for three project sites, scenarios identified and run together with project partners.
3.	Economic analysis of household FTL-based fattening systems in NTB and NTT	Report on the economics of household FTL-based cattle fattening systems in 4 case study areas selected by LPS/2008/054	Reported in detail in Waldron et al. (2016). However, covers three rather than four sites. Luk in Sumbawa was dropped as the variation in results and possible scenarios had been exhausted after the three sites, and would yield few insights compared to the additional input required. In addition, only one fieldwork visit was possible to Luk
4.	Value chain analysis of FTL-based fattening systems in NTB and NTT	Report on value chains including policy and institutional analysis in NTB and NTT	Reported in detail in Waldron et al. (2016). The value chain analysis (and the associated macro level data) outlines some of the structures, players and conduct in the chains that enabled broad conclusions and recommendations to be drawn (relevant to the fattening sector). The analysis did not use quantitative methods or formal VCA methods to upgrade chains, as this was beyond the scope of the project (data, time, objectives).
5.	Module for project training manual on economics of FTL-based cattle fattening systems	Paper designed to complement broader training manual	This was not done. There was consensus that partners in NTB and NTT were in a better position to write this training module and deliver in training programs – in language, terms and approach – than the Australian partners were. However, the full range of concepts, tools and results to use in these modules are provided in the project report and model.
	Project final meeting	Report and presentation on findings from SRA	Done in the project final meeting of LPS/2008/054 in Carnarvon, December 2015. In attendance were nearly all project members (including Australian and Indonesian project leaders, researchers and field staff) and ACIAR. The presentation covered major aspects of the research (household budgeting, value chains and macro settings) but only preliminary findings were presented. The meeting provided an excellent opportunity to contextualise the economics research in the broader project, and to update parameters (from field researchers and Halliday) for the modelling.

4 Conclusions and recommendations

4.1 Conclusions

The design, findings and tools of the research are summarised in the Executive Summary and the substantive project report (Appendix 2) so are not repeated here. Rather, some reflections on the research and broader conclusions for ACIAR are provided.

This economic research has filled an obvious gap in research on tree forages and fattening in Eastern Indonesia and, as intended, provides an economic verification of the viability and sustainability of the systems. It could be argued that this research could have been conducted at the beginning (rather than the end) of the broader FTL-fattening research, but it is positive that this emerged from due consideration and review of the program.

The economic research has been developed within the broader project LPS/2008/054 and with project partners, but subject to further specialist economic analysis and reporting in LPS/2014/034. Project partners and other projects are now able to interpret, adapt, use and disseminate the research and the tools in ways best suited to ongoing work in the area. This includes the formation of Indonesian and provincial policies, and multiple programs and projects in the beef industry.

4.2 Recommendations

Further research in areas relevant to, but not covered by, this report that could be consider by ACIAR and other agencies includes:

- On participatory training of households and extension agents in farm budgeting and management, based on research such as LPS-2014-034, but adapted to maximise uptake and communication. While fattening households in West Timor, Lombok and Sumbawa respond quickly to incentives and opportunities (i.e. are commercialised), formal training of households in basic budgeting and farm management skills is likely to assist in the uptake and improvement of FTL-fattening systems.
- On the role of finance, banks and loan intermediaries (which are also buyers) in promoting the uptake of the FTL/fattening systems. Interviews in this and other research projects suggests that there is a significant supply of capital (especially through banks subsidised through various programs) and significant demand for capital (from households) and that this latent supply/demand can be better linked. R&D agencies may play a small but key role in facilitating the loans (e.g. financial plans) and in supporting the productivity of the systems.
- On the opportunities for development of feed (especially FTL-base feed) markets and chains to fill feed gaps, including transport, preservation and storage. Applying market values to feeds such as leucaena and sesbania may encourage farmers to take up growing and feeding, but application of opportunity costs may also have the opposite effect.
- On the economics of cow-calf production (not just fattening) based on FTL diets.
- Economic analysis of FTL systems in systems where conditions are harsher (with longer dry seasons, poor soils, where it is more difficult to establish FTLs, or where yields area lower) and that do not have established cattle fattening systems or markets would be instructive. This is especially the case if FTLs for cattle production are extended to areas like northern Timor Leste, the central dry zone of Myanmar or Sumba. Research in this project suggests that the economic viability and attractiveness of FTL-based cattle production is variable and not automatically positive.

5 References

5.1 List of publications produced by project

Scott Waldron, Johanis Ngongo, Silvia Kusuma Putri Utami, Tanda Panjaitan, Baiq Tutik Yuliana, Mic Halliday, Dahlanuddin, Max Shelton, Jacob Nulik, Debbie Nulik (2016) *Economic analysis of cattle fattening systems based on forage tree legume diets in Eastern Indonesia*. Report for Australian Centre for International Agricultural Research Small Research Activity LPS-2014-034. 86pp.

6 Appendixes

6.1 Appendix 1:

Full budget workbooks calibrated for Oebola, Nyerot and Jati Sari and containing all reported scenarios.

A budget template which includes line-by-line explanatory notes (no scenarios)

These have been disseminated to project partners and several other ACIAR projects, and available in the dropbox for LPS/2008/054.

Scans of the spreadsheets are provided in the report in Appendix 2

6.2 Appendix 2:

Scott Waldron, Johanis Ngongo, Silvia Kusuma Putri Utami, Tanda Panjaitan, Baiq Tutik Yuliana, Mic Halliday, Dahlanuddin, Max Shelton, Jacob Nulik, Debbie Nulik (2016) *Economic analysis of cattle fattening systems based on forage tree legume diets in Eastern Indonesia*. Report for Australian Centre for International Agricultural Research Small Research Activity LPS-2014-034. 86pp.

ACIAR Small Research Activity LPS-2014-034

Project report

Economic analysis of cattle fattening systems based on forage tree legume diets in Eastern Indonesia

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1 Introduction

1.1 Objectives

Research and government agencies in NTB and NTT provinces have identified two systems that have high potential to increase productivity and incomes in the cattle sector: improved cattle feeding practices through forage tree legumes (FTL, *sesbania* in Lombok and *leucaena* in Sumbawa and West Timor); and the development of more efficient and specialised cattle fattening systems. These are the focus of ACIAR project LPS/2008/054 "Improving smallholder cattle fattening systems based on forage tree legume diets in Eastern Indonesia and Northern Australia". The project is now in Phase 2, with a focus on assessing barriers to and drivers of adoption.

This report is designed to support LPS/2008/054 by providing economic verification of the FTL-fattening systems, the economic incentives for farmers to adopt and adapt systems, and identifying agribusiness linkages to increase incomes and outreach.

In this regard, the major contributions of the project and this report is to:

- Verify the economic incentives for farmers to adopt FTL-fattening systems in NTB and NTT
- Identify agribusiness linkages to increase incomes and outreach
- To provide to project partners and stakeholders a robust economic model of FTL-fattening systems NTB and NTT that is user-friendly, can be constantly updated and used to simulate a wide range of scenarios.
- To assemble, describe and contextualise information about household FTL-fattening systems in NTT and NTB around the economic analysis and budgeting

1.2 Methods

With a focus on FTL-based fattening systems in NTB and NTT, the report presents data from multiple levels: from the macro level (national statistics and policy); to the meso level (industry structures and conduct); to the micro level (household). Multiple sources of data are drawn on and cross-verified including: secondary statistics (production, trade, prices); interviews with government agencies and agribusiness actors; site monitoring data of LPS/2008/054; and in-depth focus group meeting and interviews with farmers in project sites. The report also draws on extensive data and analysis in Waldron *et al.* (2012).

In line with LPS/2008/054, case study sites used for analysis are:

- Predominant corn cropping with strip planting of leucaena, and individual household fattening
    - in Oebola Desa, Fatuleu Sub-District, Kupang District, West Timor, NTT
    - Widely applicable across southern Kupang including Amarasi
- Predominant rice cropping planted with sesbania on bunds, and communal fattening
    - Nyerot Desa, Central Lombok District, NTB
    - Also applicable to sites in North Lombok
- Predominant corn cropping with perimeter planting of leuncaena and individual household fattening

- Jati Sari Village, Sumbawa District, NTB
- Results are applicable to other sites in Sumbawa and Sumbawa Barat districts

It is important to note that these are "successful" project sites, so are not representative of sites that are less efficient or profitable. However, scenarios conducted in the case study sites include parameters from low performance households and the full range of scenarios.

Two trips were taken to the NTB, NTT and project sites in May 2014 and July 2015, where interviews and focus group meeting were conducted with cattle producers, as well as traders, banks and government officials. The analysis draws on production-side data from LPS/2008/054 and on agribusiness data from ACIAR project AGB/2012/005 "Eastern Indonesia agribusiness development opportunities – analysis of beef value chains".

The report assumes strong prior knowledge of the systems under review as the main audience are researchers and government officials associated with LPS/2008/054, and other (ACIAR) cattle and forage projects conducted or under development in Eastern Indonesia.

After the Executive Summary, the report provides an up-to-date overview of broader trends in national and provincial beef industries (Section 2). Section 3 analyses value chains and household economics of FTL-fattening systems in NTT, which is replicated for NTB in Section 4. Conclusions are drawn about the potential agribusiness initiatives to increase prices and outreach, and the conditions under which FTL-fattening is viable.

The term forage tree legumes is used in this report to refer to leacaena and sesbania.

1.3 Value chain approach

The value chains relevant to FTL-based fattening and project sites for both NTT and NTB are overviewed in the report for two purposes. The first is to identify sales methods and channels that may increase household cattle sales prices and returns. The second is identify agribusiness actors and systems that may assist in extension, outreach and scaling up FTL-based fattening systems. As a capital-intensive activity, bank finance for fattening is examined. Analysis is based around a generic value chain map to guide description of key agribusiness structures and actors. Information and data is drawn from fieldwork interviews for both this report and AGB/2012/005 as well as local government data. While the analysis covers the main agribusiness structures and agents in the areas, it does not cover all, which are available in other studies (e.g. Nimmo-Bell, 2007; Deblitz et al. (2011); Waldron et al., 2013) and understood by project partners in NTT and NTB.

1.4 Budgeting approach

To assess household structures and incentives for FTL-based fattening, a budget was developed for representative cattle fattening households in the four case study sites of LPS/2008/054. The budget is available on request. Features of the budget are:

- It is a partial budget, insofar as it is focuses on the activity of FTL production and cattle fattening. Other household activities – crop production, cow-calf production, off-farm work etc. – are only considered as inputs into the fattening systems. A separate budget has been used for complementary or alternative activities (e.g. corn in Oebola).
- The focus on tree forages and cattle fattening allows for in-depth and comprehensive analysis of the systems and accounts for even small costs and revenues associated with fattening.

- The budget is easily understood and changed by users, and designed for use and revision by project partners and stakeholders. All budget items and formulas are explicitly stated in Excel spreadsheets.
- It is a steady-state budget, with production and returns assessed over a specified fattening period. That is, the budget does not capture herd and investment changes over multiple years. This is appropriate given that specialised cattle fattening regimes are almost always less than 365 days. Confining the budget to a fattening period allows increased specificity - for example rations and weights gains over a dry or wet season, or the targeting of markets and price seasonality. Longer term capital investments (FTL, kandangs) are depreciated over the lifespan of the asset and allocated to the fattening period.
- A "base scenario" has been established in each case study site, based on average values of data collected in LPS/2008/054 and focus group and household interviews. A range of scenarios are run for each site. Some effects and sensitivities (e.g. weight gain and capacity utilisation) are applicable across all sites. Once established in the first site budgeted (Oebola), these are not always replicated in other sites. Rather, subsequent sites concentrate on scenarios particular to that site (e.g. price alignments in Nyerot and cattle sales channels in Jati Sari).
- Any number of scenarios are able to be run to test production and income effects by adjusting the parameters of the budget (e.g. rations, weight gains, fattening period, price, capital investment, labour cost, sales channels etc.).
- The budget does not account for environmental costs and benefits of FTL-based fattening systems including reduction in over-grazing, soil enrichment from FTL and manure, and the substitution of biogas for firewood collected.
- To overcome the contentious issues of valuation of labour and income effects, input sheets disaggregate labour and non-labour costs. This allows budget summaries to report on gross incomes (excluding labour costs), net incomes (including labour cost at market value), labour days, and returns on labour. Returns in owner-keeper relationships can also be assessed.
- The budget is designed to provide verification of the economics of FTL-based cattle fattening especially as a reference for researchers in LPS/2008/054. The budget may provide a level of detail and rigour that will be of interest and use to industry stakeholders (banks, government and extension agents). It will be too detailed for direct use by farmers, but researchers on LPS/2008/054 will develop a simplified version for use in farmer training.
- The budget is a more important and useful output from the economics project than this report, and partners and stakeholders are encouraged to use and modify it.

1.5 Summary of Results

1.5.1 Household budgeting

Cattle fattening based on a diet of forage tree legumes (leucaena and sesbania) is intuitively an attractive economic activity.

- With no or limited market value, the tree forages are a low cost input, where costs are confined mainly to the labour of establishing and collecting the feed.
- Once established, the forages provide feed in variable climatic conditions and decent weight gains if cattle are healthy.

- Cattle fattening is capital intensive, but allows for rapid turnover of cattle and capital.
- Cattle fattening is not land intensive and can be done under various ownership (owner-keeper) arrangements so inclusive of a wide range of households.
- Beef markets have been buoyant for more than five years and fundamentals suggest that this will continue into the foreseeable future in eastern Indonesia (but subject to short term fluctuations).
- FTL-based fattening systems are said to be growing and disseminating in parts of both NTT and NTB where LPS LPS/2008/054 is operating.

The underlying profitability of FTL-based fattening is reflected in budget results conducted for this report.

- Based on project data and interviews, a "**representative household**" budget was established for different systems tested in West Timor, Lombok and Sumbawa.
- There are significant differences in the profitability of cattle fattening in **wet season compared to dry season**
- **In wet season**, the representative households in all sites were profitable, measured as gross profits, net profits (including capital costs) and net profits (including capital and labour costs). It is unusual for small-holder agricultural activities to have positive net returns taking into account an opportunity cost of labour.
- **In dry season**, gross returns were also positive, but turned negative when capital and labour costs were included. However, these returns are far higher than fattening systems without leucaena/ sesbania (which are unviable in any measure of profitability). Farmers also often adjust to seasonal differences by scaling-down operations in dry season.
- Another indicator of profitability widely used when there are limited opportunities for farmers to work off farm (low opportunity costs of labour) is to estimate **"Return to person days"**. In line with results above, in wet season the representative household earns more than average (off-farm) wages, but less in dry season. However, returns to labour per day are not likely to make the average farmer rich. For example, a farmer fattening four head in Jati Sari would earn about A$6 per day in wet season and $1.60 in dry season. These returns are however more consistent than casual labour and is also a source of identity and pride for farmers. It is also important to note that cattle fattening generates cash income, which is required to pay for important cash expenses (education, health, assets like motorbikes or housing).
- To synthesise a "with and without FTL" scenario, a budget was established for cattle fattening based on a straw, grass and other supplements (rice bran) with low weight gains. Because of the low costs, gross returns were positive, but net returns are negative and daily returns to labour are about $0.80, well below the poverty line.
- As could be expected, budgets are most sensitive to productivity (**weight gains**). Even with higher labour costs, the best performing households can earn twice that of average performing households. The worst performing households generate negative gross returns.
- Profitability is strongly impacted by the **alignment of feeder and finished cattle prices**, which can change even over a single fattening period. For example, if fattened cattle prices in Oeobola are 15% higher than feeder cattle prices (due to market movements or seasonal

factors) then net returns increase by 62% compared to the representative household (where feeder and fattened cattle prices are at parity). Opposing alignments have the opposite (negative) effects. Profitability in Nyerot has declined as gap between fattened cattle and finished cattle narrowed and then "crossed over" (where feeder cattle are more expensive than fattened cattle on a per kg basis).

- If households can raise more cattle (e.g. five vs four head) using existing facilities (kandang, FTL and machinery) and lower marginal labour inputs, then lower depreciation costs mean a higher profitability. However, economies of scale and **capacity utilisation** is not a major determinant of profitability compared to productivity and prices.

- While the representative household incurs **capital costs** based on an opportunity costs of capital (8%), households that access subsidised credit under KKPE (6%) increase profitability, but by only 5.4%. A commercial loan (13%) reduces net returns by 12%.

- Because comprehensive data is not available on changes in weight gain over different stages of a fattening period, the budget is not able to test the effects of changing weight gains over **changing (longer or shorter) fattening periods**. However, the fixed costs of buying and selling cattle and veterinary costs when entering the kandang, mean that longer fattening periods (240 days) are slightly more profitable than short periods (120 days).

- A budget of corn production in Oebola suggests that returns to person days (in the period of corn production) are comparable to wet season cattle fattening. Returns are obviously subject to prices and rainfall (with a drought in much of West Timor in 2015/6). If leucaena is planted on the perimeter, yield losses from shading and moisture is assumed to be 10% with an equivalent reduction in returns.

1.5.2 Value chain initiatives

- Cattle marketing systems are dominated by a hierarchy of a large number of actors that supply cattle into the local butcher and live cattle export markets.

- These **spot market systems** do not operate perfectly – chains can be long and farmers lack formal market information. However, they are generally low cost and competitive (with some exceptions in downstream sectors) and farmers have become increasing adept in accessing market information through informal channels, and in buying and selling cattle.

- Replacing these spot market systems with alternative (more formal or direct) systems is costly and create a series of other challenges. Nevertheless, the case for **more direct linkages with agribusiness actors** – for sales and backward extension services – has been considered.

- In this regard, a potentially important development in the agribusiness sector in recent years has been the development of **new or renovated abattoirs** that have slaughter lines and take ownership of cattle. These are located near Mataram (Lombok), Kupang (West Timor) and Taliwang (Sumbawa Barat). The latter two are designed to export beef (to Jakarta) at premium prices that can be passed back to small-holder producers, thus increasing incentives to increase production and productivity, with support from government and R&D agencies. This has not come to fruition as, in all cases, the abattoirs are operating under-capacity or have stopped operations due to underlying costs and viability. Most fundamentally, the abattoirs have not been able to capture markets and premiums that enable them to offer higher cattle prices than competitors with lower cost structures (butchers and live cattle exporters). In addition, cattle catchment areas for the abattoirs are limited and – contrary to expectations – herds may have contracted rather than expanded (see above).

- Thus, other actors act as “lead firms” in local beef industries, especially **cattle marketing companies and exporters in West Timor and slaughter cattle exporters in Sumbawa**. There is some scope to collaborate with these actors through modest activities. This could conceivably include repetitive sales arrangements, but this would have to be on a larger scale and catchment area than a single village or group.
- Perhaps more importantly, the large networks of the companies would be of assistance in extension activities (e.g. to communicate buyer requirements, participate in field days and to disseminate materials). Notionally these companies have incentives to help in the scale up of proven technologies and practices (tree forages for fattening), but the companies tend to work on low costs structures and immediate time horizons.
- There appears to be considerable potential to stimulate the cattle fattening sector through **bank finance**, especially under the KKPE scheme which provides subsidised loans for cattle fattening. In areas where viable and technically sound production and management systems have been established (with tree forages), banks have shown strong willingness to lend under the scheme and under criteria that can be met by a significant range of households and groups. Access to credit can be important in overcoming upfront costs of entering into cattle production and in buying necessary inputs. In NTT, access to loans appears to have been “captured” by groups “recommended” by powerful marketing/export companies, but access seems more widespread in NTB. Policy that allows the transfer of allocated KKPE funding between bank branches, as well as activities to assist households to plan and manage cattle fattening systems, would expand supply of and access to finance. R&D agencies (including project partners) have an important role to play in supporting efficient farm management, feed and fattening systems.
- There are a number of **policy and chain inefficiencies** that fall under the responsibility of government.
    - For inter-provincial and inter-island live cattle export, rudimentary infrastructure as well as duplication of holding and quarantine periods and processes add extra costs (weight loss and handling) that are passed back to producers in the form of lower prices.
    - As is well-known, there are oligopolies in downstream sectors of some parts of the live cattle export trade (shipping in NTT and breeder cattle exports in Lombok)
    - The sector is best by a series of industry policies, including cattle redistribution and allocation of export quota (inter-island and inter-province). As is well documented, these can be distortionary.
    - Government has also proactively encouraged the development of new and refurbished abattoirs on a premise of “value adding” within the area, that can be counter-productive.

1.5.3 Macro conditions

- The Cattle and Buffalo Census of 2011 projected **cattle numbers** in Indonesia to be 16 million head in 2013, which are the numbers recorded in official statistics. A broader agricultural census conducted in 2013 found the number was lower at 12.6 million head. Cattle numbers were revised down by even more in the agricultural census in NTB (35% to only 650,000 head in 2013), while the revision was minor in NTT (to 803,000 head in 2013).
- Quota on the import of cattle and beef into Indonesia was increased between 2013 and 2015.
- Exporting provinces (NTB and NTT) manage inter-province and inter-island trade through **export quotas**, which are distributed to districts, based on an assessment off herd structures. NTT only exports slaughter cattle, while brucellosis status in NTB allows for the export of breeding females.
- **NTT** has traditionally exported roughly the same number of cattle that is slaughters. Quota limited exports to only 55,000 head in 2015, but this doesn't take into account the large number so informal exports (including about 5,000 head sourced from Timor Leste). With limited other economic activities, c**attle export is big business in West Timor**.
- **NTB** exports far fewer slaughter cattle (about 20,000 in 2013, virtually all from Sumbawa) and an additional 17,000 breeding females (predominantly from Lombok). This compares with provincial slaughter numbers of 75,000 head, where there is high demand for beef, especially in Lombok.
- The export trade is the major market for two sites in this study (Oebola and Jati Sari), while Nyerot sells into the local butcher trade.
- **Supply, demand and trade dynamics are expressed in beef prices**. Beef prices in Jakarta increased rapidly between 2011 and 2012 to reach a peak in February 2013 but stablished over 2013-15 to reach Rp96,000/kg in February 2015. The price of beef in Jakarta is about 11% higher than Surabaya and Mataram, and about 35% higher than Denpasar and Kupang due to transport and other costs. There is also significant seasonality and intra-year fluctuation in beef prices, with increases of around 10% leading into Idul Fitri and a large number of local events (festivals, holidays, weather / season, payment of school fees before term starts).
- Data from project sites show that local cattle prices have broadly increased with beef prices over recent years, but that they are not always closely integrated due a large number of localised factors. High prices benefit cow-calf producers most directly (although it can increase short-term incentives to sell cows). High prices also benefit fattening households insofar as they earn higher prices per kilogram gained over the fattening period. However, like other intermediate stages of the chains, buoyant prices increases input costs – in the case of specialised fattening households, feeder cattle. Fattening households gain if prices of fattened cattle increase at a higher rate than feeder cattle prices, but in highly competitive markets differentials have declined and some cases even reversed (where feeder cattle and more expensive than slaughter cattle on a per kg basis). Input-output price alignments have a large impact on profitability of fattening households (see above).

2 Macro trends

This section presents statistical data that indicates trends in the Indonesian, NTT and NTB cattle industry. While these are presented at a macro level, there are important implications for cattle producers in project sites.

2.1 National

For cattle production, in 2011 the Ministry of Agriculture and the Central Statistics Agency conducted the national bovine census (MoA and BPS, 2012). The census found that the national herd had already reached 14.8 million head, well above the figure used in annual reporting (12.6 million head). Based on these numbers, projections were made for 2013 for 16 million head, which is the figures still cited in livestock statistics. A broader agricultural census was conducted in 2013, which found the number was lower at 12.6 million head in 2013 (shown in *Figure 1*). Possibly in response to this, and rising prices (see *Figure 4*), the quota for live cattle imports were increased slightly to 380,000 head in (shown in Figure 1) and further in 2014 and 2015. A further 42,000 tonnes of beef were imported in 2013, up from 31,000 tonnes in 2012. This appears to have stabilised beef prices over those years (see *Figure 4*).

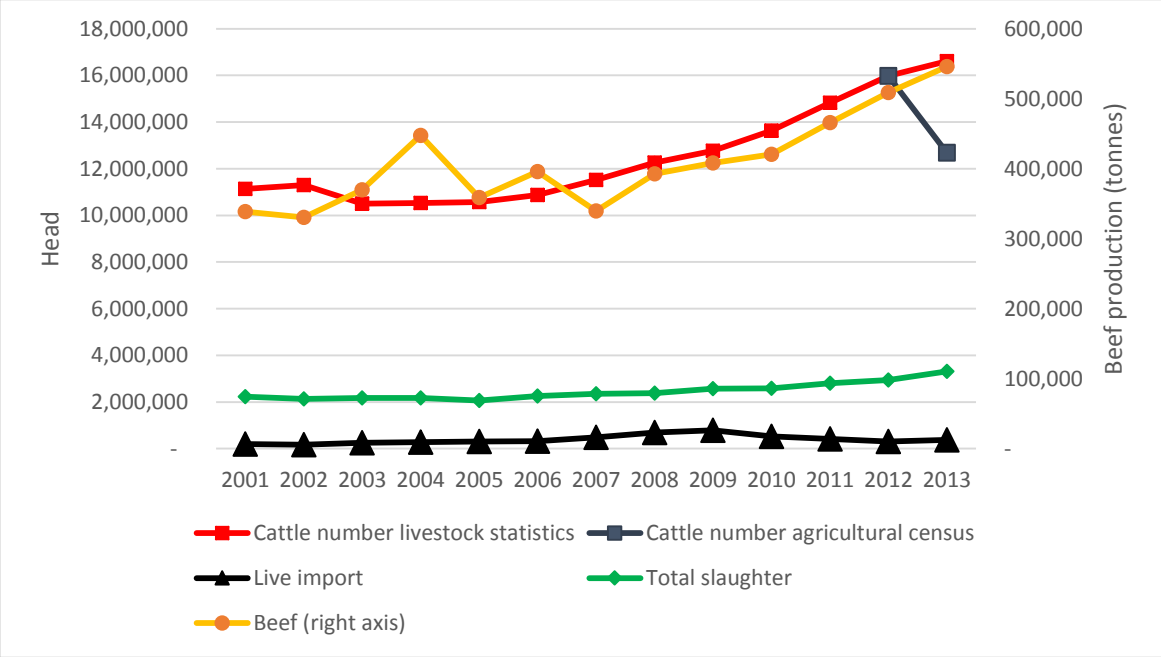


Figure 1. Indonesian cattle production, slaughter, beef and imports, 2001-13.

Source: DGLAHS (various years); BPS (2013); UNComtrade (accessed 2015)

Livestock slaughter numbers used above refer to slaughter in registered slaughterhouses. Based on analysis by Hermansyah and Mastur (2008) as well as NTT statistical data that records slaughter in unregistered slaughterhouses, total slaughter is likely to be 25% higher, as reported in *Figure 1*.

Data cited above allows for derivation of several indicators. The turnoff rate refers to number of cattle slaughtered (in registered and unregistered abattoirs) as a proportion of cattle numbers, adjusted by trade balance (exports and imports). This acts as a broad indicator of the degree of commercialisation of the industry, especially the time taken for cattle to reach slaughter weight and sale, and that cattle are kept for long indefinite periods as a source of “savings”. Based on cattle numbers recorded in livestock yearbooks, the turnoff rate in 2013 was 18%, which is higher

than the 20% in 2001-2007. However, using lower cattle numbers recorded in agricultural census, the turnoff rate is much higher at 25%. The average carcass weight (derived from beef production and slaughter numbers) increased over the period to 165kgs in 2013 (although this may be overstated).

2.2 NTT

Equivalent data for NTT is shown in Figure 2.

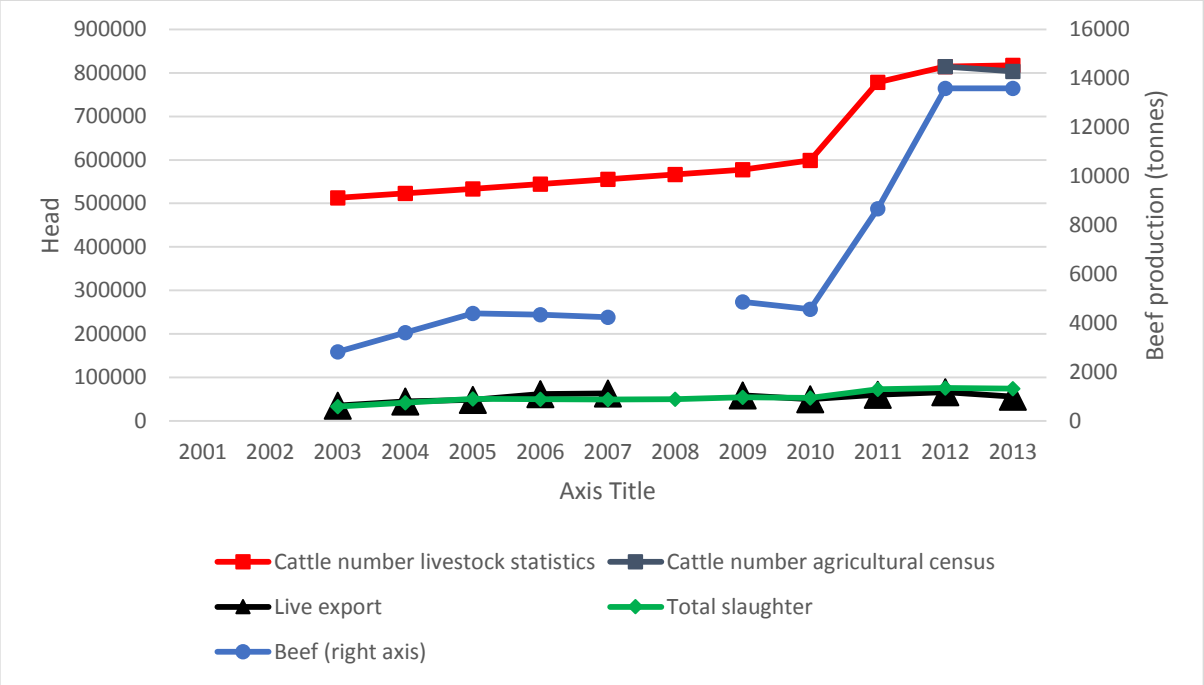


Figure 2. NTT cattle production, slaughter, beef and exports, 2001-13.

Source: NTB BPS (various years); DGLAHS (various years); BPS (2013)

Recorded cattle numbers increased steadily in recent years to of 817,000 head, with only a minor revision in the agricultural census (803,000). Cattle slaughter numbers increased rapidly between 2010 and 2011 to 73,000 head (12,000 of which is in unregistered slaughterhouses). This is partly due an increase in the slaughter of cows driven by high prices and demand from abattoirs. The ban on the slaughter of productive females is not enforced any stage of the chain.[1]

NTT has traditionally exported roughly the same number of cattle that is slaughters. Due to Brucellosis status, these are all bulls for slaughter vaccinated for septicaemia epizootica and anthrax. The trade is regulated by quota set on estimates on herd structure.[2] Quota is allocated down to districts (e.g. Kupang District has a quota of 11,000 head in 2015). A minimum export weight of 27kgs was set, but because supply in this range was insufficient has been relaxed to 250kgs.

[1] Dinas Market officials for example claim that "they don't know where the cows go". Abattoir officials say that by the time they reach the abattoir, it is too late to stop the transaction (butchers already have ownership, and they are worried about driving more cattle into unregistered slaughter houses).

[2] Dinas works off (not entirely accurate) herd numbers, and assumptions of 23% herd increase, 4-5% death rate, 8% sold out by traders and 8% for local slaughter. This leaves 2-3% to build the herd, or quota can be adjusted by +/- 10% per year.

Possibly because of higher slaughter numbers, quota has been reduced from 66,000 in 2012 to 56,000 in 2013 and 55,000 in 2015. While it is not possible to quantify, perhaps tens of thousands of additional bulls are exported without permits (including up to 5,000 head from East Timor). NTT has a long-established sales channels to Jakarta (transhipped through Surabaya) but Kalimantan has emerged as a major buyer, due to growth in the market and smuggling into Malaysia, where prices are high (and also the destination of carabeef from India).

There may be a statistical anomaly in the beef production for NTT (8,500 in 2011 to 13,500 in 2013). Turnoff rates (for slaughter and live export) in NTT were only 16% in 2013, down from 20% in 2007, reflecting uncommercialised systems. Average carcass weights in 2011 were 119kgs.

2.3 NTB

Livestock statistics record that NTB had a beef cattle herd of one million head in 2013, but this was revised down by 35% in the agricultural census to 650,000 head. The revision is more proportionate to the total slaughter numbers (75,000 head) and beef production (11,500 tonnes), not dissimilar to NTT. Export numbers are much lower than NTT (37,536 head in 2013). As Lombok is declared free of brucellosis, this includes breeding cows (16,743 head in 2013). Due to Indonesian government cattle distribution programs, the cattle are exported to large number of distant areas, of which the main market is Kalimantan (54%) and Papua (32%).

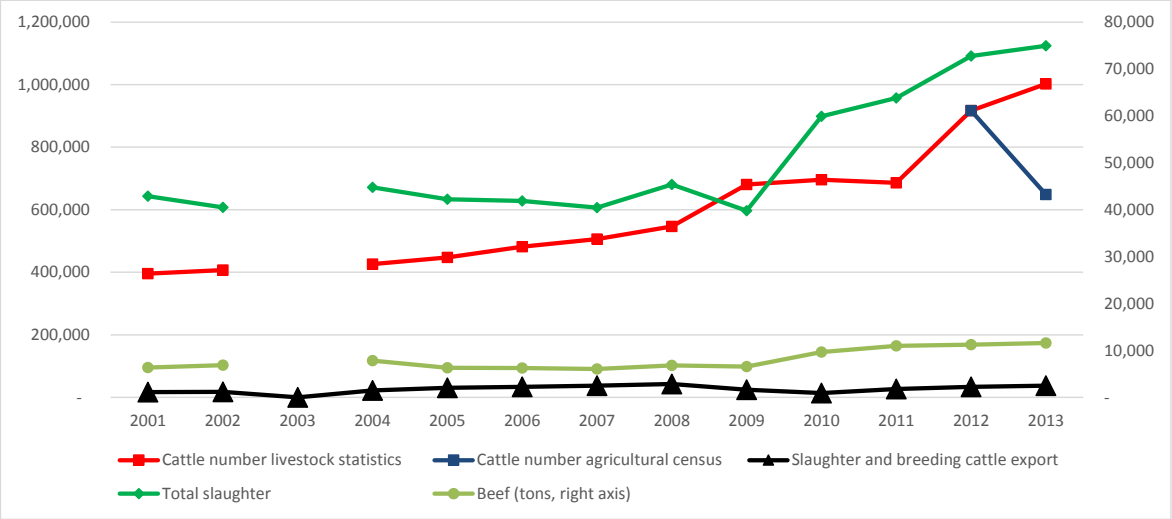


Figure 3. Indonesian cattle production, slaughter, beef and imports, 2001-13.

Source: NTB BPS (various years); DGLAHS (various years); BPS (2013)

Quota is allocated on similar basis to NTT. However, because of the premiums for breeding cattle, this trade is regulated (by governor decree) by export standards and prices.

Based on livestock statistics, turnoff rates have declined from 15% in 2007 to 11% in 2013, but these increased to a more realistic rate of 17% using statistics from the agricultural census. Average carcass weights 154kg appear overstated.

2.4 Prices

These broad macro forces culminate in beef price levels and trends presented in this section, which have a strong and direct influence on cattle prices and returns to producers in NTT and NTB. *Figure 4* reports on weekly (2011-2012) and monthly (2013 to March 2015) beef prices in Jakarta. Beef prices in Indonesia are high by world and regional standards and an average of three times more expensive than the most highly-consumed meat, chicken. Prices increased rapidly

between 2011 and 2012 at an average of 10.6% per year in Jakarta. However this was in line with increases in chicken prices, lower than average inflation rates and lower than expected GDP and income increases, making beef no more expensive for the average consumer.

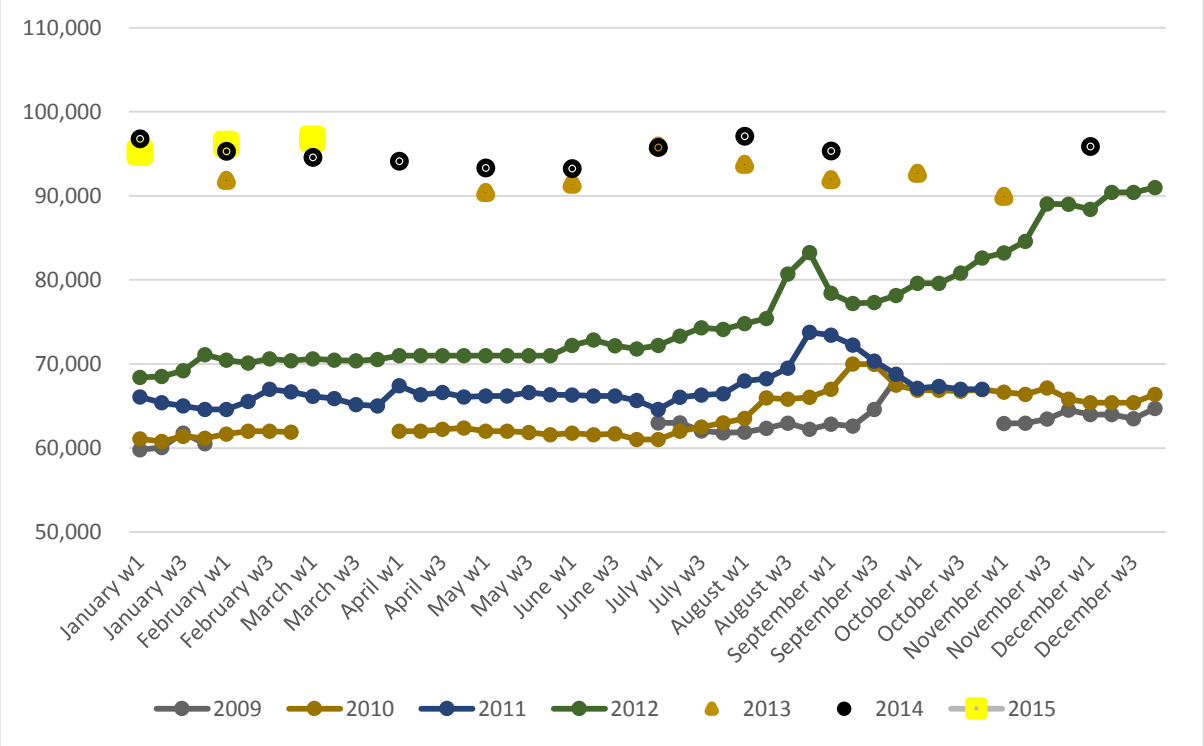


Figure 4. Weekly beef prices in Jakarta, 2009 to November 2012

Source: MoA (various years)

Jakarta beef prices were Rp74,000 in August 2012 leading into Idul Fitri that year. With high demand and constrained imports (315,000 head in in 2012), prices had leapt to Rp92,000 by February 2013 at a rate well above inflation, previous years and other meats. Perhaps because of subdued demand (price elasticities) and certainly because of imports in 2013 and 2014, prices stablished reaching Rp96,000 in February 2015.

Figure 5 presents weekly (2011-2012) and monthly (2013 to March 2015) beef prices in three cities (Jakarta, Surabaya, Denpasar) and monthly prices in Mataram (2012) and Kupang (2013 to 2014). For comparative purposes, chicken meat prices in Jakarta and an inflation index are included.

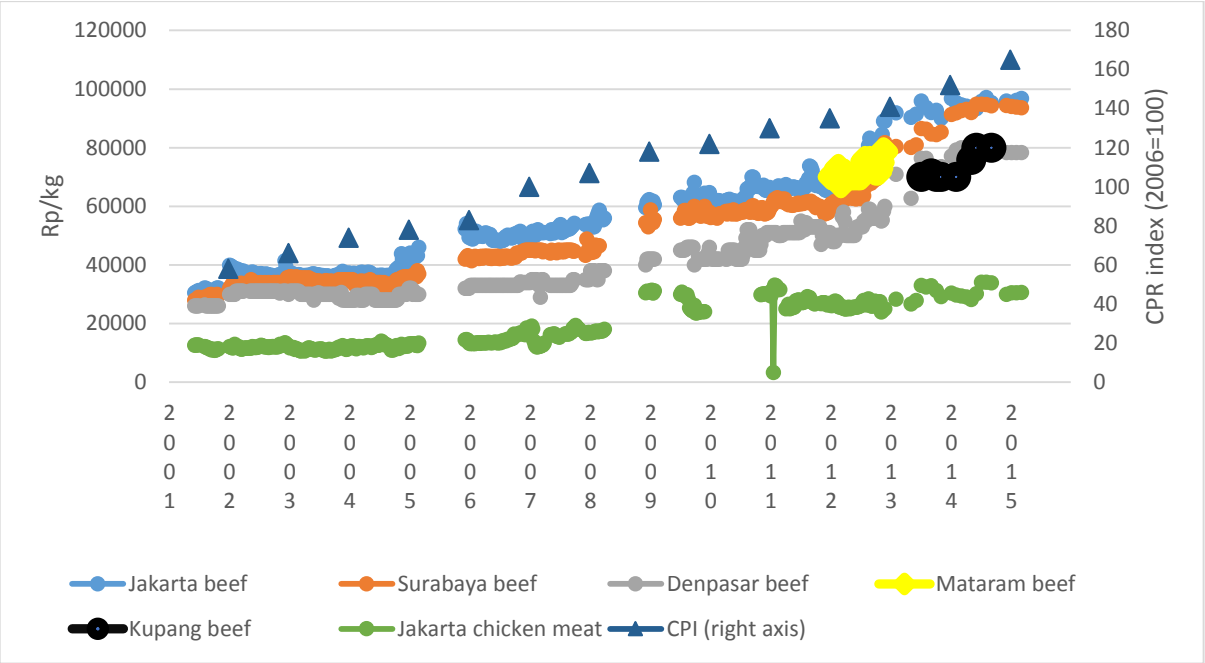


Figure 5. Inflation, beef and chicken meat prices in selected cities, 2001-2015

Source: MoA (various years)

The price of beef in Jakarta is considerably higher than it is in cattle production areas to the east; an average of 11% higher over the period than East Java (Surabaya) and 35% higher than Bali (Denpasar). Mataram prices (only available in this series for 2012) are similar to those in Surabaya. Kupang prices are similar to Denpasar, and amongst the lowest in Indonesia. The prices tended to move together in the short term suggesting an integrated beef market. However, integration is constrained by domestic trade policy (provincial and local quotas) and price differences can be higher than the costs of inter-regional trade. For example, the price difference for beef between Jakarta and Kupang was Rp13,000 in June 2014, which at 250kgs LW, would be Rp1.6 million in animal value. This is higher than the Rp1.1 million per head for transport, quarantine and other services.

The price differentials explain the significant trade of heavier slaughter cattle from NTT to Jakarta. The price differentials between Mataram and Jakarta are not large enough to sustain a slaughter cattle trade, but may be for Kalimantan, while regulated prices for breeder cattle are high enough to sustain a breeder cattle trade.

There is also significant seasonality in beef prices – shown in *Figure 4* as "waves" of price increases of around 10% leading into Idul Fitri.[3] These price increases are reflected in cattle price increases in NTT and NTB. Farmers and traders capitalise on these opportunities by selling cattle in the months leading into Idul Fitri. However, there are many other events throughout the year that influence prices (festivals, holidays, weather / season, payment of school fees before term starts) which means that prices fluctuate significantly within any given year.

2.5 Policy

Policy settings have a significant effect on cattle production and value chain functioning at national down to local levels. Industry policies are summarised in *Figure 6* and detailed for Eastern Indonesia in Waldron *et al.* (2013). It is not possible in this report to fully update this detail, but

[3] Idul Fitri fell on 21/9/2009, 10/9/2010, 31/8/2011, 19/8/2012, 8/8/2013, 28/7,2014 and 17/7/2015.

examples are raised in provincial sections for the report. Fieldwork and expert opinion suggests that these policies have continued into the new Indonesian government regime and, in some cases, strengthened.

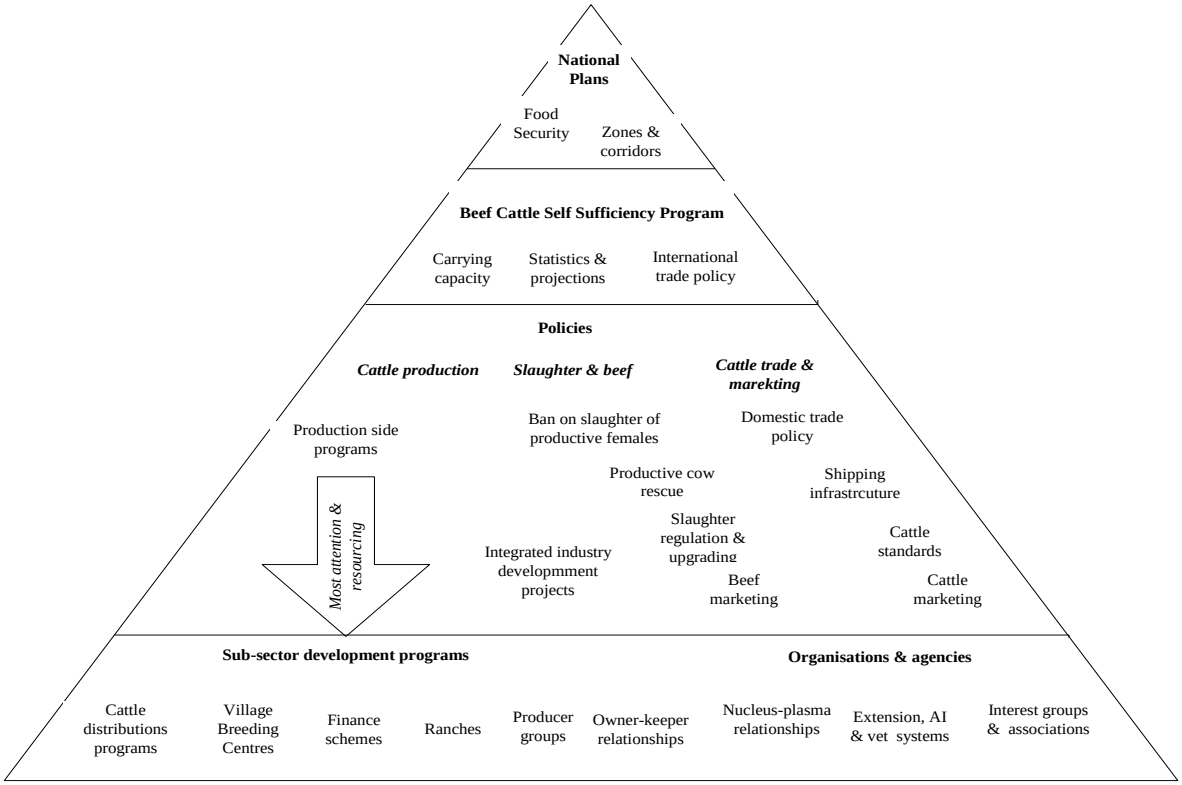


Figure 6. Policy hierarchy for the eastern Indonesian cattle and beef industry

Source: Waldron *et al*. (2013)

3 NTT

After the macro statistical perspective above, analysis now turns to value chains and the economics of household cattle production in NTT.

3.1 Value chains

Figure 7 shows the industry structure and actors in the beef cattle industry in both NTT and NTB. Rather than using simplified and potentially misleading arrows and numbers, a generic diagram is used to guide more detailed discussion below. Components of the chain are identified through numbers (A1, C4 etc.). Analysis focuses on West Timor and in particular around Kupang Municipality and District, where the project site Oebola is located. The industry has a very active agribusiness sector both for local and export markets, which opens up opportunity for agribusiness initiatives to increase prices and outreach.

Figure 8 shows the location of key infrastructure of the livestock industry in Kupang District. Red crosses show the location of centres for the rescue of productive females, red arrows represent animal health centres, green arrows livestock markets (with the Lili market shown as a purple arrow), and red and black arrows the slaughterhouse in Kupang City (Noel Baki).

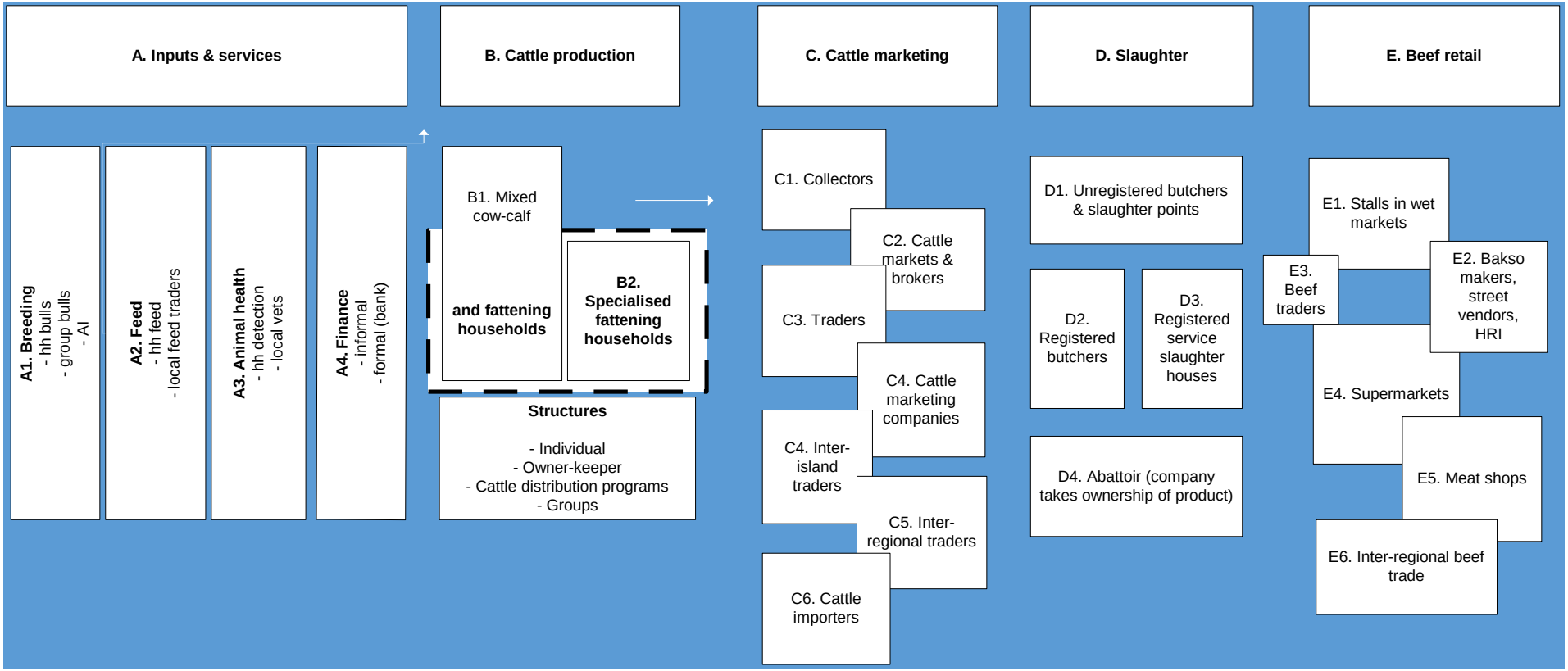


Figure 7. Generic value chain of beef cattle industry in NTT and NTB

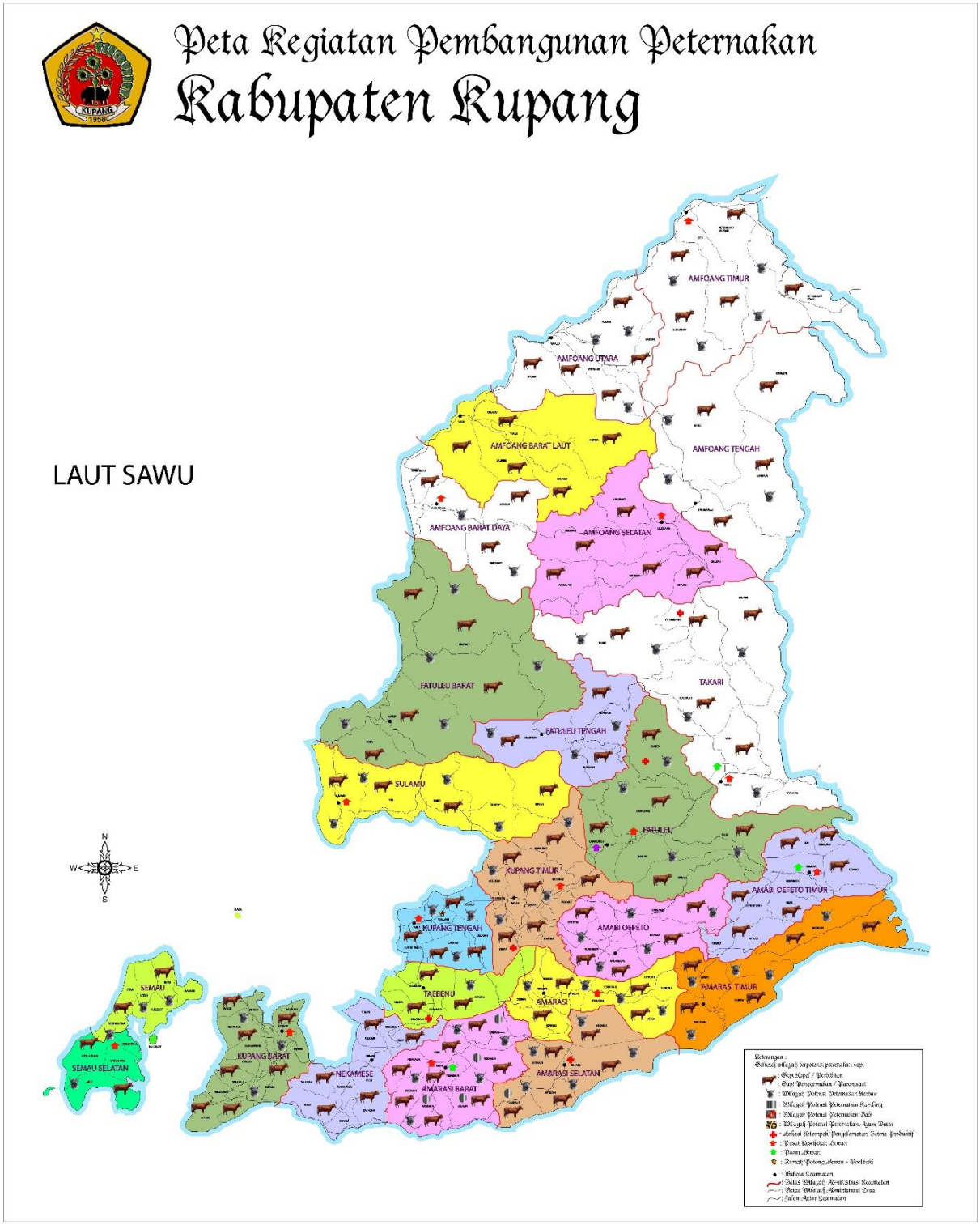


Figure 8. Map of key livestock infrastructure in Kupang District

Source: Kupang District Dinas Livestock

3.1.1 A. Inputs

A1. Breeding is dominated by natural mating using own herd bulls of Bali cattle. In 2012 only about 10,000 cattle (around Kupang) are AI'd per year (partly because liquid nitrogen containers and straws can only be moved by ship so can take long periods of time to get from Bali and Java to NTT). However, Dinas has plans to expand the system to inseminate 50,000 head through AI, 60% with Bali

breed genetics and the rest cross breeds. There are risks involved in a breed program dependent on timely detection and insemination.

A2. Feed. The vast majority of feed is sourced from on-farm resources through grazing, cut grass and crop residues. There is however a modest and localised market for feed, mainly for cattle that are transported and held for the local and export trade. For example:

- Site monitoring data in Oebola records that four farmers sell tarramba to traders that hold or transport cattle from the nearby Lili market. The sellers received an average or Rp1,000 per plant, with a variable number of cuts.
- A large cattle exporter that holds many hundreds of cattle in holding/quarantine yards (STMJ / VTP) said that a truckload of leucaena costs Rp1 million and king grass Rp1.5 million. Because of the high costs, he only feeds cut grass, despite the significant weight losses in holding. Other exporters with their own feeding facilities (e.g. Bumi Tirta) have planted their own feed.
- Site monitoring data also records that some farmers have sold significant amounts of improved Tarramba seed (750kgs in one case), at an average price of Rp47,000 per kg. This is because the improved variety was distributed through the project, and farmers in other villages / areas recognised the value of planting it.
- The development of a leucaena feed and seed market is a significant step in development of the cattle sector. It may facilitate outreach of the feeding systems, may reduce inefficiencies in critical stages of the chain (holding and transport) and increase recognition of the value of better feed. Against this, few households are prepared to make cash outlays to buy feed, and profitability is sensitive to the valuation of feed.

There may be more direct incentives for cattle traders and exporters to buy feed. A formal assessment would reveal the costs-benefits of a better ration in holding and shipping. When asked, a common response was that their margins are already slim. Holding times can be long and very variable (depending on time to aggregate a lot and shipping and administrative delays). Some of the weight lost in holding and shipping can be quickly put back on again in feeding at destination (Jakarta) through compensatory gain, although feed costs there are said to be higher in Java.

3.1.2 A3. Animal Health

Animal health services are provided by government through animal health centres (puskeswan), a separate line agency within Dinas Livestock, with have independent centres at sub-district levels. These are staffed by veterinarians or lower level “animal paramedics”. Farmers, traders or butchers pay for the advice and services of veterinarians separate to their official work. Amongst the relevant animal health issues for cattle fattening are:

- Researchers on LPS/2008/054 generally provide veterinary treatment in sites like Oebola (and other sites) so that feed trials are not confounded. They recommend that farmers treat cattle for basic animal conditions (e.g. liver fluke), although farmers can be reluctant to pay for these costs.
- However, some farmers appear willing to pay for vitamin supplements (Vitamin B), which are expensive (e.g. Rp50,000 per dose) and are of questionable value especially with sufficient feed and disease treatment.

- Importantly, slaughter cattle destined for (formal) export are required to be vaccinated for anthrax and septicaemia epizootica (with accompanying documents). Thus farmers targeting this market (for heavier bulls) can call in animal paramedics to provide this treatment or exporters with direct links to farmers can coordinate the treatment. However, cattle seen transacted in spot markets (dealers and markets) did not have documentation, so there can be a risk of delays at quarantine (holding periods delays). If not vaccinated at household level, traders do the vaccination.

3.1.3 A4. Finance

Cattle fattening is a capital-intensive business even at household level. Households can source feeders from their own herds or can purchase feeders from savings (accumulated profit), both of which incur an opportunity cost of capital. Farmers without their own feeders or savings – or that want to expand operations – can obtain feeders through government distribution programs, owner-keeper relationships (profit-sharing), contract fattening (e.g. PUSKUD) or through credit. Credit can be informal (e.g. loans from friends or traders) or formal (banks). This section concentrates on formal bank lending.

The most active bank in the cattle fattening sector in NTT is BRI. BRI is a state bank with a mandate to participate in government credit programs including for agricultural and rural development. The BRI branch in Kupang has a number of products for farmers that step up in scale: from small loans in revolving funds at subsidised rates for development purposes (Kredit kemitraan); to middle sized loans at subsidised rates for production purposes (Kredit Ketahanan Pangan dan Energi, KKPE); to larger loans at commercial rate.

KKPE is targeted at a number of commodities and activities of which small-scale cattle fattening is one. Under the program in NTT, government subsidises loans at a rate of 7.75%, farmers pay an effective rate of 6% and returns to banks are therefore 13.75%.[4] However, the liquidity of the loans remain with the banks, so incur risks and must apply normal lending conditions. Banks are concerned about the capacity of farmers to repay loans especially due to variable productivity and a lack of collateral to back the loans. As a result, uptake of the KKPE funding facility for Indonesia as a whole has been low.

Uptake has however been high in Kupang (and NTB). For example the Kupang regional branch (that covers Kupang District, Kupang city, Sabu District, and Rote) loaned out its' full allocation of Rp12 billion for 233 people (Rp6 billion per financial year 2013/4 and 2014/15). They requested that additional allocation be transferred from other areas (provinces like NTB and Bali) that have not used their allocation (NTB, Bali). Cattle is "core business" in NTT.

While banks are very interested in opportunities to expand their business in cattle, this is only provided to areas and households that meet lending criteria. The most important criteria was productivity and financial viability to repay terms (assessed through simple calculations). This is based strongly an endorsement and assistance from sub-district Dinas and extension (PPL) staff. Research agencies (BPTP and Universitas Cendana) can also play a role. BRI has visited numerous efficient cattle producing areas in Amarisi – and Oebola several times – to assess systems, but did

[4] Other terms of the loan are as follows. The loan is not flat, but can be offset by any profit from sales or savings and linked to savings account. Loan amounts Rp100 mil per household, whether as an individual household or as group (the latter is preferable to reduce transaction costs). The initial loan is for one year, but can be extended to a maximum of three years. The aim is that the loan is paid back and the household / group moves up to enter into a more commercial loan product.

not loan in Oebola because a lack of collateral (land certificates, cars, government staff salary). Banks consistently claim that collateral is not necessary in some cases, but is required in most to install a sense of responsibility on the lenders that are used to handouts.

A major catalyst in the Kupang BRI case are links to an individual (Daniel Go) that buys cattle for the largest cattle exporter in NTT (STMJ / VTP) and who is head of the NTT Association of Businessmen in Cattle and Buffalo (see 3.1.6 below). The company acts as a facilitator of the loans, but not a guarantor. He also organises vaccination required for export. In return, the exporter buys the cattle to aggregate loans. The exporter / association have organised credit, vaccination and offtake agreements with 15 farmer groups across West Timor. Of these, 14 are small groups and account for about 2,000 cattle, and access KKPE loans. He buys another 3,000 head from another "group", which is more like a co-operative / marketing company called TSM in East Amarisi, which accesses commercial loans, and then on-loans to co-op members.

3.1.4 B. Production

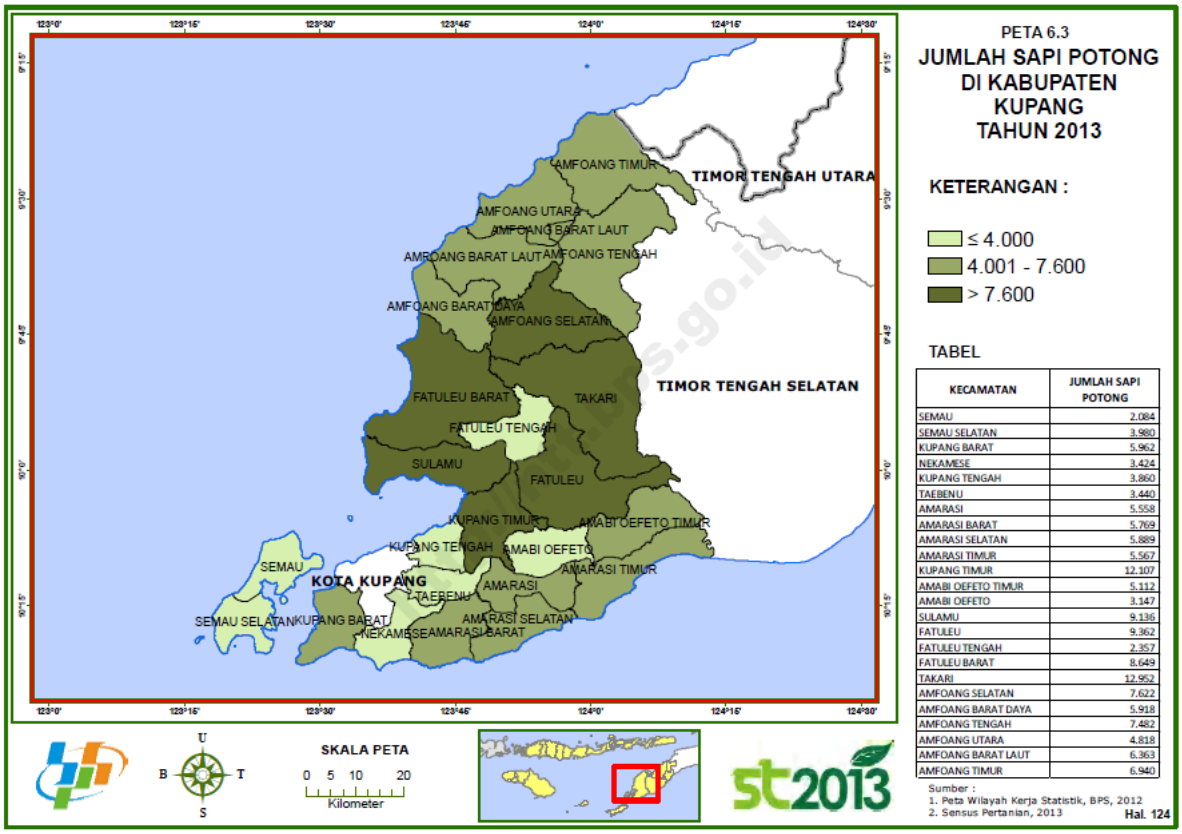
The production systems of West Timor are well understood and not elaborated here, but some of relevant structures are overviewed briefly.

Production systems

- About 80% cattle in NTT are produced in extensive production systems (Mulik, 2012).
- Policy-makers cite large areas of unused grasslands in NTT that can support a 38% increase in cattle numbers. This is based on an estimated amount of useable grassland of 832,000 ha. (revised down slightly from 888,000 ha). However, if a carrying capacity of 0.31AU/ha is used for grassland areas[5] then NTT is already over-stocked (Mulik, 2012).
- Over-stocking leads to grassland degradation, weed invasion, and poor nutrition for livestock.
- As a result, policy-makers and researchers have turned attention to more intensive production systems, including the planting and harvesting of leucaena, and pen-feeding of cattle, especially fattening. These systems are well established in areas like Amarasi in Kupang, and attention is turning to scale-out.

Cattle numbers and densities in Kupang District are shown in *Figure 9*. District Dinas Livestock distinguish between more extensive cow-calf systems in the north of the district and more intensive fattening in the south, including Amarisi and Fateleu (Oebola).

[5] *Based on Based on 1,450 kg DM/ha, feed utility 70 percent, 3% DM consumption by 300kg LW AU (Genetics Quality of Bali cattle in NTT)*



KECAMATAN	JUMLAH SAPI POTONG
SEMAU	2.084
SEMAU SELATAN	3.980
KUPANG BARAT	5.962
NEKAMESE	3.424
KUPANG TENGAH	3.860
TAEBENU	3.440
AMARASI	5.558
AMARASI BARAT	5.769
AMARASI SELATAN	5.889
AMARASI TIMUR	5.567
KUPANG TIMUR	12.107
AMABI OEFETO TIMUR	5.112
AMABI OEFETO	3.147
SULAMU	9.136
FATULEU	9.362
FATULEU TENGAH	2.357
FATULEU BARAT	8.649
TAKARI	12.952
AMFOANG SELATAN	7.622
AMFOANG BARAT DAYA	5.918
AMFOANG TENGAH	7.482
AMFOANG UTARA	4.818
AMFOANG BARAT LAUT	6.363
AMFOANG TIMUR	6.940

Figure 9. Map of cattle numbers in Kupang District

Source: BPS (2013a)

Employment and scale

Data on the number of cattle producers – that can potentially benefit from improved production, marketing and policy – is difficult to estimate.

- In August 2013, it was recorded that there were 60,000 livestock producers in NTT, the majority of which would hold cattle (DGLAHS, 2013).
- In 2007, 74% of cattle producers in NTT were small holders that owned 1-10 head, with an average of 7.2 head or 4.05 animal units (Mulik, 2012).
- With an expansion in the recorded herd from 555,000 in 2007 to 817,000 head in 2013, it is likely that the scale of production has increased, either by small-holders, or larger farms.
- Perhaps more accurately at a local level, in Fateleu Sub-district, it is recorded that were 9,950 cattle in 2013 (source) raised by 1,513 livestock producers (making an average of 6.6 each). It is recorded that Oebola has 227 livestock producers (Kecamatan Fatuleu, 2011), which accounts for the vast majority of the households in the village (Section 3.3.1).
- Cattle also play a social role – not for social standing, but for ceremonies and cultural demands, and as a source of “savings” that can be cashed in for cash needs (housing, schools fees, motorbike etc.).

B1 and B2. Cattle producers

Cow-calf production is done mainly in extensive grazing systems in NTT, but there is commonly penning at night, and feeding of FTL to cows. Research in ACIAR Project LPS/2006/005 has promoted the confinement of calves, introduction to solid feed (including leucaena) and early weaning of calves (to reduce calf mortality).

However, the majority of FTL production and pen feeding is done for cattle fattening. These cattle can be sourced and separated from the breeding herd of the household, can be purchased in, or can be from "friends or businessmen" on a contract/owner-keeper/profit-sharing arrangement. Details are elaborated in budgeting in Section 0.

The emergence of a specialised cattle fattening sector is very significant in the development of the industry. It can concentrate skills and resources to a particular activity to increase efficiencies. It can increase demand for better-bred calves (from the cow-calf sector), can be more responsive to market demands (slaughter, trade) and increase the commercialisation and activity in the market. Of particular interest in this report, it has the potential to generate positive cash flows that are increasingly required in a society transitioning from a subsistence to a cash economy. The numbers of households that could potentially benefit are significant (see "Employment and scale" above).

3.1.5 C. Cattle marketing and trade

This section provides a brief overview of the cattle marketing structure, but focuses on the implications for selling at household level.

C1. Collectors don't take ownership of cattle, but receive a fee for assisting traders to source and aggregate cattle. They can potentially play an important role at a local level in seeking information on prices and terms, aggregating cattle and logistics. In Oebola, collectors didn't appear common as dealers are able to deal directly with traders. Because of the close distances (especially proximity to Lili market) and density of cattle, dealers were said to be prepared to buy in small lots or even a single animal.

C2. Dealers. There are large numbers of cattle traders in West Timor NTT that operate in several parts of the cattle marketing chain. Some dealers buy from households and sell at market, some buy from households or at market or and sell to exporters or slaughterhouses, others buy and sell at market often on the same day, while others operate in all multiple stages of the chain. At household level, dealers are dominant buyers of cattle from households in Oebola, where there might be 10 active buyers. This provides households with competition and a source of (albeit) imperfect and indirect information, as discussed below. **D1 and D2 butchers** can sometimes buy direct from farmers in small regular numbers (e.g. lots of 5-7 twice a week).

C3. Cattle markets. While some dealers that buy for larger actors (abattoirs and exporters) can buy direct from farmers, many seek to reduce transaction costs and purchase risks by buying at market, which is key node in the chain.

There is only one active and operational cattle market where there is a sufficient density of cattle, which is located in Kupang District (Lili) and other smaller collection areas (a fattening area in Braun) and small animal market in TTS District. Lili is located in central position between the breeding areas in the north, fattening areas in the south, and on a main road to slaughter and port facilities in Kupang District. This is also located very close to the Oebola site.

Lili is a periodic market open for cattle on Wednesdays, with spillover trade into Thursdays, and small animals on Fridays into Saturdays. Up to 700 head can be exchanged on Wednesdays in busy periods (Idul Fitri, Christmas/New Year and when farmers sell cattle to pay for school fees. On a Wednesday when the market was visited 400 head were sold (recorded by Dinas Livestock officials that collect retribution of Rp18,000 for market entry and Rp2,000 tethering area). Volume are highest at the end of wet season (May to July) and lowest in dry season (feed availability).

In line with national standards on cattle markets (at A– district, B – sub-district, C – village) and investment in the sector, Lili market is being upgraded and expected to be finished in September/ October 2015. This was said to include installing electronic scales that can record weights, and numbers. Market officials thought that traders would use the scales (although this isn't the case where there are scales in Lombok and East Java, but are apparently used in Bali). The loading ramp installed when visited in 2012 was not used.

In the market, there were areas for the sale of different types off cattle, though these were permeable. As an anecdotal guide:

- Heavier bulls were bought for the export trade. One full truck (10 head) at a weight of 290-310kgs sold for Rp7-8 million each (Rp25,000/kg). A prize bull of about 550kgs sold for Rp14 million, as a special for Idul Fitri.
- Perhaps half the cattle in the market were cows. A minority of the cows were not productive (old and several with prolapsed uteruses) which sold for around Rp3 million. Most of the cows appeared in good condition and cows of up to 300kg sold for around Rp6.5 million. While some may have been used for breeding, all the buyers interviewed were butchers, including one mid-sized private abattoir (Aldia).
- Weaners and calves of around nine months old with a body condition score of 3 are expensive at up to Rp3.3 million each. This may be because these require small initial cash outlays for farmers to fatten.
- A few buffaloes were on the market, with large animals of around 350kgs selling for Rp7 million.

Prices were said to be low on the day / period visited (early July 2015) because buying for Idul Fitri was finished and there was a glut of cattle of farmers selling to pay school fees. Prices at the market were significantly higher than when last visited in October 2012 (around Rp22,000/kg LW).

There were perhaps 150 people at the market including a large number of cattle loaders and spectators. It can be hard to discern between some of the actors – for example, brokers often claimed to be traders, and buyers sometimes claimed to purchasers of an abattoir or exporter, but were actually independent suppliers. Few farmers sell directly at market because of the social norms and specialised nature of the business. (This is a bit different to NTB (Lombok) where farmers can take cattle to market, but then also seel through brokers).

C4. Cattle production and marketing companies

One of the features of the West Timor cattle industry is the presence of perhaps 10 large cooperatives or companies that link with cattle farmers, but are effectively cattle financing and marketing operations. This groups are of interest because they are significant producers (turn off at least 10,000 head in total) and have strong established networks with many thousands of farmers. Productivity in the systems is low, so may provide an efficient vehicle for the extension of technical support, especially leucaena-based fattening.

Two well-known contract cattle fattening organisations are PUSKUD and TLM. They source large amounts of working capital (from banks, export companies, NGOs and church donations) to buy feeder cattle, which are sent out to farmers for fattening for sometimes up to a year. The cattle are weighed on dispatch and return to the company and the weight gain multiplied by a set price is used to derive determine "profit", which is split 70:30 by the farmer and the agency. PUSKUD used to run auctions and sell cattle to major exporters (but was also looking to sell to the Segarau Bahari abattoir). PUSKUD has 3-4,000 cattle on contract with 1,500-2,000 farmers, and TLM has about 500 cattle with 250 farmers. PUSKUD claim to provide technical and veterinary support but fattening periods and weight gains are low.

There are also a number of large grass-root cattle "cooperatives" (marketing companies). One called Sejati is based in Tesbatan Village, Amarasi. The cooperative started with a government distribution of 500 head and a feed base of leucaena planted in the 1960s, and incorporates about 2,500 head (of all types) and 22 breeding groups and five fattening groups, each with about 20 farmers. The cooperative runs numerous activities including: cow distribution (with a proportion of calves "returned" to the co-op); owner-keeper fattening (70:30 profits sharing); and finance (the cooperative sources funding from bank and through the endorsement of traders and Dinas to lend to households (uncollatoralised) at a commercial rate + administrative charges of the cooperative). The co-op sells slaughter cattle of the cooperative herd (a few hundred head), but much more importantly, about 3,000 bulls from non-members. Prices are based on a weight-price standard, and are slightly higher (Rp1 million / kg) for co-op members. In 2012 the cooperative had about 30 ground staff (including "technicians"). The cooperative head (Pak Ardi) draws a salary and margins on purchase-sales prices.

There is another co-operative in East Amarisi in Kupang City called TSM that also brokers loans and marketing across a range of commodities in NTT, including cattle sales (about 3,000 per year) and loans with BRI (at commercial rates). Cattle are sold to big exporters to Jakarta (Daniel Go).

Other cooperatives and "social groups" are said to exist including Koperasi Setara, YMTM and Yayasan An Feot Ana.

C4. Inter-island/provincial traders. Because of the large numbers of cattle in West Timor, few cattle are imported from other islands to NTT. From Sumba, cattle can be shipped directly from Waingapu to Jakarta. Inter-island traders are most relevant in the Sumbawa-Lombok trade (Section 4.1.5).

3.1.6 C5. Inter-regional exporters (associated with C6.)

The cattle trading and export trade is big business in NTT. One source claimed that there are 23 registered traders but many of these are inactive and many have exited the business over the years. One large exporter said that that there were seven exporters in Kupang, Atambua and Rote, in addition to others in Sumba[6] and Belu/TTS[7]. It should be noted however that individuals can run their export business under several company names. Some of the major exporters are overviewed briefly below (based on information in 2015).

Daniel Go owns UD Sukses Terus Maju Jaya (STMJ) and five other inter-island cattle trading companies that exports around 20,000 cattle per year through VTP. About 5,000 cattle are sourced from producers that he has direct links to: 2,000 head in 14 cattle groups; and 3,000 head to a "cooperative" marketing company (STM in Amarasi). The other 15,000 head come from about 50

[6] Traders in Sumba include Toko Nusantara, Sinar Sejahtera, Mustafa Al Djufri and Ali Umar Fadaq
[7] These include Yohanes Bitin, Jimmy Tan, Wismirus Kase, Acin Manek and Amin Nurobo.

dealers. **Bernard Ratu Ke** owns Baru Timbul and two other cattle export companies. Both Bernard and Daniel manage the larger trading company PT. Varietas Timor Permai (VTP) owned by Dicky Budianto.

These managers have links into related structures

- As Chair of the NTT Cattle and Buffalo Raisers Business Association (HP2SK)
- liaise with local governments especially to negotiate export quotas
- have links to numerous cattle production cooperatives and marketing agencies
- and organize finance for cattle production groups, cooperatives and marketing companies (including part financing of PUSKUD) (see 3.1.1 above).

Bumi Tirta is the name of the cattle trading company based in Jakarta, and operates in NTT as Bina Taruna and Sinar Surya. The local companies export 100-150 head every 10-14 days (so up to 3,500 head per year) to Jakarta. Cattle are held in a feedlot in Kupang District that can hold 200 head, and they have their feeding and breeding operations. They buy from 13 dealers that they know and trust, and require a "stabilisation period" of three days on "normal feed" before weighing and buying. The company provides an upfront payment to the dealers of 70% of the estimated value of the animal, with the balance paid after three days stabilisation. Prices at the time of visiting were Rp29,000/kg <300kgs LW and Rp30,000 for >300kgs LW. The cattle are fed in a feedlot in Jakarta (capacity of 2,000 head) for at least one week to stabilise and are then sold into the slaughter trade.

In addition to the legal exports conducted through export permits (within quota), there are large numbers of illegal exports. The trade is of course known by government, but say it difficult to police the five or six ports in West Timor alone – in Belu (Wini), TTU (Atapupu), Kupang (Tenau), Atambua.

Two companies in the NTT cattle export companies are facing hearings under the anti-corruption commission (kapika – litbang).

C6. Shipping and cattle import. While there appear to be numerous cattle traders, marketing companies and exporters in NTT, only two companies provide shipping services for cattle from West Timor to Jakarta/Surabaya and Kalimantan (other options are available in Sumba). In turn the sea transport is controlled by one very well established and powerful company – PT Varietas Timor Permai, VTP – owned by the Hartono family based in Jakarta. This provides the company with enormous leverage to dictate export activity (i.e. stop "outsiders" including PUSKUD from exporting directly themselves, although is possible in Sumba).

Table 3 provides a picture of the numbers, seasonality and destination of cattle from Kupang District.

Table 3. Inter-provincial trade of cattle from Kupang District, 2013

	Total No. (Head)	**Main Destination**	
		Jakarta (Head)	**Kalimantan (Head)**
January	1,850	350	1,500
February	1,359	550	809
March	1,300	950	350

April	1,400	1,000	400
May	2,875	1,875	1,000
June	2,100	950	1,150
July	2,750	1,700	1,050
August	600	300	300
September	1,650	525	1,125
October	850	450	400
November	750	300	450
December	2,000	1,400	600
Total	19,484	10,350	9,434

Source: Dinas Livestock, Kupang District. Note: small numbers of cattle traded to Sulawesi are included in Kalimantan destination, and small number to Surabaya included to Jakarta destination.

In Kupang, slaughter cattle are held in quarantine for seven days for detection of major diseases, with no quarantine period during transhipment at Surabaya.[8]

3.1.7 D. Slaughter and E. Retail

As part of measures to upgrade the industry and diversify sales channels from the live export trade, central down to local government as well as the private sector is renovating and investing in slaughter infrastructure. If viable, this has the potential to increase and diversify competition and cattle prices in the future.

Slaughter operations bridge several sectors of the chain. They can be integrated downstream in beef retailing. They can buy a lot of cattle themselves (rather than through dealers) so are also active in cattle marketing. The butchers and abattoirs interviewed prefer to buy at market rather than direct from households to reduce transaction costs, and so that they don't have to "look for" cattle from farmers and thereby raise price expectations. Cattle purchase is the most important aspect of the business for butchers (and even medium abattoirs like Aldia) so the boss usually buys cattle himself, rather than delegating to employees or outsourcing to dealers.

D1 and D2. Independent butchers.

The local wet market trade is supplied by butchers that manage a small crew of slaughtermen and women at service kill plants. Official statistics (BBPS NTT, 2014) records that there are 52 slaughterhouses in NTT, eight in Kupang District and four in Kupang Municipality. If so, many of these are inactive. The largest in Kupang is Oeba RPH, where 15 active (three inactive) butchers kill 35-40 head per day and up to 50 around Christmas. The plant contains decent holding yards, water and concrete flooring (but poor drainage) in a central seaside part of the city.

[8] In 2005/6, 20,000 cattle from NTT were held up in East Java due to concerns about anthrax

However the plant will be shut down, and replaced by two RPH / service kill plants due to open at the end of 2015:

- a new government abattoir owned and invested by central government but run by municipal govt government (Bimoku)
- and another one invested and managed by Kupang District government (Noelbaki).

D4. Abattoirs.

There are also a number of private abattoirs that take ownership of cattle and sell their own products. This is significant as it offers potential for direct linkages on scale with farmers.

Aldia slaughter 30-40 head per week in Kupang. It hangs carcasses overnight with a chiller capacity of 10 carcasses, and then butchers into the full range of cuts. The beef is all for local consumption, sold through two Aldia butcher shops (one in a grocery store). While the company has been of interest to some projects (e.g. USAID), it is not a target for this project because it now slaughters cows. The buyer said that cows are cheaper and that if butchered well produce good beef.

Segarau Bahari is new private abattoir that opened in July 2014. The modern plant consists of a large holding area, kill box, mechanized slaughter line, a boning room, cryovac equipment, chiller, blast freezer and 40 tonnes of cold storage. The company is only licensed for export (of all products) and cannot sell locally. Beef is shipped in containers to Surabaya and then truck to Jakarta as a supplier for a major distributor Nusantara Food. Export volumes were said to have started at only one container per month, then were said to increase to two per month by the end of 2014, and about one container per week (13 tonnes) by 2015.

The plant was said to slaughter about 30 head per day, every day. They can hold 150 cattle in the (well-equipped) feedlot / holding yards. They buy through a number of traders including Teddy (20-30 per week), Ontueus (15), Pak Ellen (25) and can assist with cash upfront for the purchases. They also claim to have established a purchase agreement with PUSKUD which can supply up to 100 head per week, but can be variable depending on cattle received back from households.

Of most relevance to this project, they also buy direct from farmers in various ways. Farmers usually come in to check price, then if happy will truck the cattle in at their own cost. Or farmers close to the abattoir can use the company truck at cost of Rp150,000/head. There seems to be quite accessible specifications and terms:

- The abattoir requires bull > 225kgs, with no age standards and no vaccinations required.
- Can be a single or several households and cattle (to share truck costs)
- The cattle are weighed and the farmers paid on the spot (no holding / emptying period).
- Prices fluctuate – Rp26,500/kg LW now, was Rp28,000/kg liveweight in May 2015.

If working and viable, Segarau Bahari therefore provides an accessible sales channels for farmers and groups that are seeking alternatives to dealers. However, the prices offered by the abattoir were lower than those offered by local traders in places like Oebola. As in other areas, mechanised abattoirs with higher cost structures struggle to compete with small butchers and live cattle exporters to purchase cattle. This may explain why the plant was not operating when visited in July 2015 and looked very clean (which was said to be because of Rahmadan). The plant stopped working for a period but began again in 2016, albeit at low capacity.

3.2 Implications for cattle marketing and extension

3.2.1 Selling methods and options

Households in Oebola sell predominantly through intermediaries (dealers) into the informal "spot" market. There are distinct advantages in this flexible and responsive system that has been improved in Oebola through the use of scales and unit (per kilogram liveweight) pricing. However farmers (and government and researchers) hold a widely-held perceptions that dealers and pay below the "real" value of the cattle to make windfall profits. This is unlikely to reflect the resources, skills and risks faced by dealers, but it is worthwhile exploring alternative selling methods and channels to improve prices and terms.

Spot markets. At household level, dealers are dominant buyers of cattle from households in Oebola, where there might be 10 active buyers. Farmers have a broad understanding of when prices might be high – for example when exporters, butchers and households have to fill an order or cultural obligation, especially for a festivals and ceremonies (see below). However, demand and prices can vary for reasons not even big agribusiness companies are aware of such as the issue of national import quota and local export quota. There is no formal price reporting system in NTT and it is costly to establish a system that is disaggregated and timely enough to be of value to either farmers or traders).

Farmers therefore tend to be "passive" receivers of price and other information, gathered from imprecise information from other farmers and negotiation with dealers. When cattle are in high demand, dealers will approach farmers, sometimes several of them, in which case farmers can negotiate a higher price. Conversely, if farmers have "to look for" buyers they become price takers, as dealers know that they need to sell (for reasons that might include cash needs or low feed supplies). There are however an infinite number of variations and "tricks". For example, a dealer might approach a farmer and offer a low price. If rejected, they might arrange another dealer to offer a lower price in the hope that the farmer might take the initial offer.

Over-the-scales selling. Cattle transactions are usually made on a per head basis. However LPS/2008/054 supplied cattle scales for cattle weighing and monitoring, which households interviewed also use for selling on per kilogram liveweight basis (set up on concrete floors in kandangs). This has significant benefits in enabling farmers to measure and quantify liveweights, which they can use to "shop around" for the highest per kilogram price, potentially across many buyers and more remotely (e.g. by phone or without dealers sighting the animals). Importantly the farmers can also draw a more direct relationship between the weight gains in feeding, with the profit that this generates, and therefore incentivise improved production practices. In principle, traders may be reluctant to use scales because they can more accurately estimate liveweight by eye than household, but it was claimed that traders were happy to buy over the scales. Traders still have a sharper eye for conformation and meat yield.

More formal sales – at farm gate. Households in Oebola had discussed the idea of entering into a more formal sales arrangement with a particular buyer (dealers, butchers, abattoirs) where they would turn off a set lot size at a set time for a set price (or for modest premium over market price). A priori this would be of interest to exporters or butchers that need supply for particular orders. However, there are drawbacks and benefits to this type of arrangement.

- Setting prices or premiums entails risk for both buyers and sellers.

- It may be logistically challenging. Farmers have different resources (feed and water) that may for example make it difficult for them to reach 250kg LW for export orders in a given period. Probably more importantly, farmers within a group often have different cash needs or obligations that can that can make coordination difficult.
- On the other hand, this is much easier to organise than, for example, controlled breeding to produce a line of feeder cattle. A *targeted* production regime may also encourage farmers to feed cattle more intensively, and to compare themselves with other households (a form of benchmarking and peer-pressure).
- It is unlikely that a single individual group would turn off sufficient finished cattle to be of interest to a major buyer to enter into formal agreement. For example, with 30 cattle on feed in the group (20 owned by households, and 10 in owner-keeper arrangement) for an average of 180 days, Oebola might be able to turn off only six lines of 10 head per year. A typical butcher might require 10 head per week, and a major exporter 100 per week.
- A dealer said that they wouldn't enter into such an arrangement because farmers might over-feed the animal (water, salt, banana trunk) to inflate liveweights. This problem however is not insurmountable with the development of trust and perhaps re-weighing after holding. Exporters pay large co-operatives (TSM) based on cattle weights measured at the farm gate.

Direct sales – off-farm. Another sales method and channel may be to sell cattle directly through markets or to exporters and abattoirs to "cut out the middlemen". This entails transport costs (a truck), transaction costs (to aggregate a line to reduce per head transport costs) and risks of "hold up" (where the cattle are landed at the buying point, the transaction is delayed sometimes deliberately, and the sellers incur costs of feed, holding and potentially transport back to the farm). Any holding period entails delays in payment, at best a return trip to pick up cash and at worst default.

Thus, any arrangement established would have to be with trusted and reputable buyers and accessible purchase terms. If so, the same benefits mentioned above – potentially higher prices and more targeted and coordinated production systems – would apply.

It was in the past possible to sell and transport to the new private abattoir near Kupang (Segarau Bahari). As stated above, however, the abattoir is operating intermittently and under well under capacity. Even if it was still operating and buying cattle, it is unlikely that it would be able to afford to pay prices that are competitive with other channels

Flexibility. Given the series of trade-offs in various selling methods and channels, households in Oebola would be best served by maintaining a flexible approach to cattle marketing. That is, farmers should keep sales options open, and sell at the highest price to any number of buyers (taking into account transaction and transport costs). This is especially the case of Oebola as it has:

- Favourable access to roads, market and abattoirs and quarantine / shipping in Kupang. The density of finished cattle in the area means that buyers are prepared to buy small lots or even individual animals, and transport costs are modest.
- There can be significant transaction costs and difficulties in coordinating across diverse households (even in a group) to enter into formal agreements. Buyers may lack incentives to enter into more formal agreements.

- Because scales are available and widely used in Oebola, this modest piece of infrastructure is valuable in cattle marketing, regardless of sales channels, provided that trust between sellers and buyers is established.

The targeting of production systems is more likely to come from targeting peak demand and price periods, and fitting in with feed and resource availability.

3.2.2 Short term price determinants

Within the parameters of broader price trends (Section 2.4) prices vary considerably over the year because of a number of factors. Some of the regular seasonal patterns are:

- Beef consumption and prices increase sharply in the weeks leading up the major Muslim festival of Idul Fitri (July/August/September in recent years). Large numbers of cattle are slaughtered at mosques for Idul Adha (Day of Sacrifice, approximately two months after Idul Fitri) where meat is distributed amongst the community and the poor. Christmas and New Year are important in NTT.
- Cattle prices can be low in period where school fees are due (preparing for the following term)
- Demand for cattle can lower in monsoon season (Dec-February) where shipping is risky, live cattle exports lower and lower export quotas are issued.

There are also a number of more irregular and unknown price determinants that cannot be factored in timing of turnoff

- Cattle and buffaloes are slaughtered for traditional ceremonies (*adat*) including burials, and weddings that can happen at various times. Graduations are more regular.
- Prices can rise or fall with the issue of national import and local export quota and permits

The income effects of successfully targeting these (regular) events are budgeted in Section 3.3.7. It is important to note, however, that targeting can be interrupted especially if households are forced to sell cattle – for example for immediate cash needs, weather/feed reasons, or ceremonial/social obligations.

3.2.3 The role of agribusiness in extension and outreach

Various agencies – government, research and NGOs – have engaged in extension and outreach activities including directly working with groups, developing training materials and programs, and integration with local government policy and extension. These strategies can potentially be complemented by coordination with agribusiness actors, *some* of which have direct linkages with large networks of farmers and already facilitate some services (technical, credit, vaccination). Some comments on the potential and strategies of linking with agribusiness to extend technical extension are provided below. These are based around different classes of agribusiness actor that have different levels of incentives to participate in extension systems.

Actors that have existing technical extension systems – high incentives to participate. Cattle "marketing companies" (PUSKUD, TLM, Sejati, TSM) have a number of characteristics:

- They interact directly with large numbers of farmers (see Section 3.1.5 above).

- Services provided include vaccination (for export markets), veterinary services and credit (in various forms). They claim to employ technicians, but maybe not in numbers required to work intensively with farmers.
- Have an incentives to increase production (to increase sales volumes and develop goodwill with farmers). Visits and data suggested that productivity was not high, compared to project groups, and that were numerous areas where systems could be improved.

These actors would seem to have incentives to participate in training programs and to disseminate training materials. Junior scientists and technical staff could conceivably be placed within these organisations.

Actors with partial interaction with farmers – partial incentives to participate

These actors include Segarau Bahari, Bumi Tirta and live cattle exporters, which buy from farmers but do not have close, repetitive contact especially in production aspects. These actors could be invited to participate in training programs and to disseminate training materials. There would be benefits (for information and trust-building) if the buyers could visit sites to explain their requirements and terms, and to assess the cattle and infrastructure available.

Other actors – limited incentives.

There are very large number of smaller actors (butchers, dealers) that play a major role in local industries, but have limited incentives to build backward linkages because their margins and cattle requirements are low. However, dealers close to sites in particular should be encouraged to understand project and extension objectives, to other areas, and to assist farmers understand market changes.

3.3 Household budgeting – Oebola Dalam village

3.3.1 Background

The budgeting for NTT focuses on Oebola village, Fatuleu Sub-District, Kupang District. The cattle fattening system is based on corn cropping, with strip planting of leucaena, and individual pens. This system is widely applicable across southern Kupang including Amarasi, which is the most famous leucaena-fattening area in West Timor. Findings may be applicable other project sites in the south of Kupang.

To provide context for the budgeting, characteristics of Oebola Dalam village are:

- In 2015, a population of 1,158 and 276 households (average 4.2 members per household)
- Total land size of 19 sq km. Household land sizes are usually 0.5-1 ha/household, but there are some households with two hectares. These are split into one to three parcels of land.
- 95% of farmers earn a living from agriculture. The main crops are corn (one crop in wet season), pumpkin and beans
- Livestock include cattle, pigs and chickens
- There are 1,453 cattle (which would make an average of 5.3 head per household)
- Most households fatten only one to two head with a maximum of eight
- Cow-calf systems are predominant, but calves are usually taken through to slaughter age. Many households buy in feeder cattle, in specialised feeding operations.
- Cattle are fed in individual household (not group) pens.
- Leucaena is predominantly planted in strips on corn land

Data used in the budgeting has been gathered from monitoring (by Charles Pakereng) of eight households with an average of 30 head between them, and in-depth interviews with five of the households. As the first site to be budgeted, discussion below works systematically through the budget.

3.3.2 “Main parameters” sheet

This sheet lists the main parameters for the “base case” / representative households in the village in both wet and dry season. The representative household has four cattle in stock for 170 days on feed. However, the household does not hold cattle every day of the year (pens assumed to be empty for 26 days of year for cattle transition or cash shortages). This effects capacity utilisation.

There is a large difference in the feed regimes and weights gains between seasons. Assuming that these are discrete (when in practice they often overlap over a fattening period) these are:

- Wet season. ADWG of 0.4kg/day based on a diet of 2.5% body weight comprised of 80% FTL (60% leucaena, 20% gliricidia), 17.5% native grasses and leaves, and 2.5% corn silage (which makes up 10% of the diet but only at the end of wet season).
- Dry season. ADWG of 0.2kg/day based on a diet of 2% of bodyweight, comprised of 40% FTL (30% leucaena, 10% gliricidia), 60% native grasses and leaves.

Predominant corn cropping, strip planting leucaena, individual household fattening			Wet season - representative househeold	Dry season - representative household
Main parameters				
Biophysical				
	Cattle numbers			
		Cattle in stock (head)	4	4
		Days of year cattle in stock	330	330
		Cattle sold over year (head)	8	8
	Weight parameters			
		LW bought in (kg)	189	189
		Days on feed (days)	170	170
		ADWG (kg / day)	0.4	0.2
		LW sold out (kg)	257	223
		LW added over fattening period (kg)	68	34
		Average weight over period (kg/head/day)	223	206
	Ration (%)			
		DM feed intake as % of av body weight (%/day)	2.5%	2.0%
		FTL (leucaena and gliricidia)	80%	40%
		Improved grasses	0%	0%
		Native grass and local tree leaves	18%	60%
		Straw / stover / silage	3%	0%
		Rice bran	0%	0%
		Other supplement	0%	0%
Market				
	Cattle prices			
		Cattle purchase price (Rp/kg LW)	29,000	29,000
		Cattle sales price (Rp/kg LW)	29,000	29,000
		Price difference	-	-
	Opportunity cost of labour (Rp/day)		45,000	45,000
	Capital costs			
		Interest rate for loans	6%	6%
		Interest rate on savings (opportunity cost own capit	8%	8%

Figure 10. Main parameters for Oebola

Cattle prices (Rp29,000/kg) represent average prices when visited in July 2015, and assumed to be the same (on a per unit basis) for feeder and finished cattle. The opportunity cost of labour is the equivalent of pay for one days' work doing transport or agricultural labour. Capital costs are based on interest rates on savings accounts (8% per year, which is assumed to be the opportunity cost of own capital) in the absence of loans (which can either be commercial or subsidised)

3.3.3 Capital investments

Capital investments are investments in items used for multiple activities over extended periods (longer than the fattening period). These can also be regarded as overhead cost in so far as they are not directly related to production volumes. These include the planting of tree forages, pens, motorbikes, water facilities and biogas facilities. The cost (both cash and labour) is depreciated over the lifespan of the asset and attributed to cattle fattening over the fattening period.

A “design capacity” is set for these items (except feed) – in the case of the representative household in Oebola at five head. Given the actual number (four head) and time not on feed (26 days) capacity utilisation is 72%.

For *leucaena establishment*, and to meet dietary requirements, the household requires 300 trees per animal (total of 1,200 for the representative household) with a 120 day cutting interval. This is planted on the land of the household – in strips. The household does not lease any land (although this does happen in Oebola). Planting costs include the fencing of land, purchase of seeds, nursery (poly bags, bedding, shade cloth) and transplanting (labour and transport). The costs (Rp309,000 for equipment and Rp585,000 labour) are negligible when depreciated over 40 years. It could be argued that this time period reaches well beyond the planning horizon of farmers and is subject to a high degree of uncertainty (so discount rates apply). If the period halved to 20 years, there is only a very minor effect on returns.

The costs of *constructing a kandang* (nails, wire, timber, cement, sand, gravel, reinforcement, troughs, roof, other) is higher (Rp1,135,00 for equipment and Rp450,000 for labour) but are also low when depreciated over 20 years, and 160 cattle fattened over the period.

The cost of a *motorbike* (used to transport feed and marketing of cattle) is high, but used over 15 years and only 20% for fattening. The group doesn’t use a straw chopper.

Most households have dug a well for Rp1,500,000 plus meals for workers that lasts 15 years.

Biogas facilities (pits and converters) are commonly installed in West Timor that use effluent from kandangs. Equipment is free (as part of a government program) but costs are incurred for meals for installers and household labour, especially digging of base and maintenance (cleaning out pits and lines).

When costs of all capital items are amortised and converted to a fattening period, capital costs on equipment are Rp186,000, while depreciation is Rp220,000. Together, these makes up <1% of total costs and eclipsed by other costs so appear to be small. However, it is important to note that these are upfront costs (in land, labour and capital) that can be very significant for households when first investing, and can be a barrier to adoption.

3.3.4 Production costs

These are costs that are incurred frequently – on a daily basis or within the fattening cycle – for cattle fattening activities, so are linked directly to production volumes. These include feeder cattle purchase, cattle marketing costs, feed costs, veterinary costs, kandang labour and crop shading.

Feeder cattle purchase cost is by far the biggest cost making up 94% of all (non-labour and non-capital) costs. Feeder cattle costs are incurred when the households buys them on the market or as an opportunity cost of fattening self-produced feeders (that could otherwise be sold). The only difference is that self-produced feeders do not incur purchase or transport costs.

Costs of both purchases and sales (“cattle marketing”) includes search costs (telephone, fuel and household labour), trucking and broker fees. In Oebola, the household is assumed to buy in cattle off-farm so incur all these costs. However households in Oebola typically sell cattle in a “passive” way (see sections 3.1.5 and 3.2.1 above) where traders seek out cattle and buy at the farm gate. Sales costs are therefore low. Marketing costs make up only 1-2% of total production costs, which seems low especially if favourable prices can be achieved. However, the time and “hassle” involved in buying and selling can be a significant consideration in the decision-making of farmers.

Feed is potentially derived from FTL and improved grasses (of the household or purchased from others), from native grasses and trees, from straw/stover, rice bran or other supplements. In Oebola, *feed from FTL* (leucaena and gliricidia) forms a major part of the diet (80% wet season, 40% dry season). After the FTL has been established (see 3.3.3), there are assumed to be no additional production costs except labour (in collecting, weeding and trimming). The representative household does not purchase FTL from other households. Labour costs for collection and transport costs are, however, significant. In west season, all members of the household travel an average of 1km (range of 0.5-5km) to collect forages, twice per day, taking 1.5 hours, or an opportunity cost of labour of Rp8,400 per day). Motorbike fuel is Rp700 per day.

The collection of *native grasses and leaves* in wet season is less time consuming because of the smaller part of the diet, but is more labour-intensive to collect (from scattered trees and bending over to cut grass). The labour costs for native grasses and trees in dry season are high (two hours per day).

Corn stalk is fed after harvest (end of wet season) until used, which requires labour in cutting, transport and storage (no chopping in Oebola) over a few days, but little after that. Labour costs are therefore low. Rice bran and other supplements are not fed.

For water, several households in the group paid for access to group water supplies (access, pipe maintenance, fuel for pump) to Rp240,000 per year of which about 305 is used for cattle fattening. The household spends half an hour per day collecting and distributing water to the troughs in the kandang.

Thus, with the exception of water access costs, all of the production costs associated with feed in Oebola are labour costs. At Rp2.5 million value of labour over the fattening period, this makes up 65% of all labour costs

The vast bulk of the remaining labour costs (Rp950,000 over the fattening period) are in *kandang labour,* where the household spends 1 hour per day in cleaning and cattle management.

Veterinary and additive costs are incurred unevenly. In Oebola, treatments include vaccination (anthrax, SE to allow for live export), one medical check (from local vet), vitamin supplement (widely used), and a small amount of salt. Antibiotics aren't administered, and there is no treatment for liver fluke. The total costs (Rp364,000) over a fattening period is small as a percentage of total production costs (2%), but are the second highest (non-labour) outlay, and are significant because they are cash outlays.

Crop shading and moisture extraction is included as another cost of production. When 1ha. of corn is planted in the wet season and strip-cropped with leucaena, it is assumed that the grain yield (of 2,400kg/ha) is reduced by 10%. Valued at Rp3,000/kg, the forgone revenue is Rp720,000, or Rp335,000 when allocated over a fattening period (both wet and dry).

3.3.5 Revenues

The sale of finished cattle is by far the largest revenue item for households (98%), but the budget also accounts for the smaller items of manure and FTL timber. As a percentage of value added from fattening (finished cattle cost minus feeder cattle cost), these items are significant (7% and 12% respectively).

Revenue from finished cattle sales is of course a function of weight increase over the fattening period multiplied by the sales price. This is explored more in scenarios below.

The economic benefits of *manure* are estimated through production (as a percentage of DM intake), which can be sold, used for fertiliser, biogas, or not used at all. Interviewees said that a lot of manure (50%) is discarded or allowed to flow from the kandang into nearby paddocks of hillsides. Small amounts (10%) can be sold for and a price of Rp250/kg dry is assumed. 20% is used for fertiliser and valued based on the substitution and value of urea and NPK fertilisers. The remainder (20%) is used for biogas which is valued based on: reduction in household labour collecting firewood (1 hour per day); and substitution for fuel (kerosene), sometimes (although not often) used for cooking and light in the household. The total value of substituted items (fertiliser and kerosene) is relatively high at Rp557,000 over the fattening period, but the substituted labour (for firewood collection) is higher at Rp700,000.

Revenues are also generated from the sale of timber from FTL. The timber from trunks of leucaena is not used as a saleable item (unlike sesbania) but branches are a source of firewood. If two branches are used per leucaena cut/harvest (every 120 days) then a large amount of firewood (3,600 branches) is collected overt the fattening period. A value of Rp100,000 is attached to this firewood.

3.3.6 Returns to cattle fattening

Given the parameters above, this section reports on the budget results (*Figure 11*). “Part A. Main parameters” of the budget summarises the main parameters of the household (see Section 3.3.2), “B. Revenues” (3.3.5) and “C. (non labour/capital) costs” (0). These are expressed on a per head basis?

Subtraction of costs from revenues provides “D. Gross profit” (which excludes capital, labour costs), converted to a per day basis. Gross profits are under most scenarios positive. In the case of wet season fattening gross returns are Rp42,319 per day, but decline to less than half of this in dry season (Rp18,847).

Capital costs must be deducted from gross profits to give net profits. Even if the household does not pay for the cost of capital (loans from a bank or informally), the household has to raise the capital which could otherwise be used (e.g. in a bank, loaned out or for business). The interest earned in savings accounts has been applied. The vast majority of capital costs (in this case 90%) are incurred for the purchase of feeder cattle. For large and expensive inputs like feeder cattle, capital costs are significant.

Subtraction of capital costs leads to “F. Net profit” (but which still excludes labour costs).

Labour costs are then deducted (per day over fattening period). The majority of labour is allocated to feed collection and watering, followed by kandang work, followed by cattle marketing and (as a small item) labour input into capital investments but allocated over the fattening period. A value for the labour input has been applied based on the opportunity cost of labour (Rp45,000 per day). Valued in this way, labour costs are invariably high and in most cases of agricultural production in developing countries, push returns negative.

It is significant that “F. Net Returns” (that includes the costs of capital and labour) are positive in the case of wet season cattle fattening in Oebola.

However, the valuation of household labour is contentious and may not reflect the actual perceptions and incentives of households. Parts G and H therefore explore other ways to express profit: as a return on labour. Part G converts labour data into labour days over the fattening period (by type of labour) and then to hours per day in cattle fattening (4 hours for 4 cattle). Part H. then converts this information to an 8 hour working day (e.g. half a day) and used to divide E and F to give

"Returns to person days". This provides an indication of the profits that a household is making from their own labour and management from cattle production, and a comparison with other farm and off-farm work.

Results for the representative household suggest that returns to cattle fattening in wet season are positive (Rp61,463), which compare favourably to average off-farm work (Rp45,000). Comparisons are not as favourable in the dry season. At Rp16,287 per day, income is on or below the poverty line.

However, it is also has to be considered that the returns to cattle production are more consistent (every day) than off-farm work which can be seasonal or inconsistent. Farmers may also be attracted to the customs and pride of running their own enterprise. Obviously the attractiveness of cattle fattening varies depending on the efficiency of their cattle fattening operation (see scenarios below) and alternative activities. In countries and regions where there are good alternative opportunities and wages are available, even efficient households are invariably drawn out cattle production.

A final form of analysis calculates returns when cattle are fattened under "owner–keeper" or profit-sharing relationships. Of the approximately 30 cattle in the project cattle fattening group in Oebola, about 20 are owned and fattened by households themselves and another 10 head are fattened under a profit-sharing (owner-keeper) relationship. Under the arrangement, the "owner" buys a feeder bull, which is fed by the "keeper" over the fattening period. In simple terms, the owner pays for the capital costs of the bull, while keeper provides the labour costs. Profits are then split in various ways – assumed here as 60% (keeper) to 40% (owner). Other costs are assumed to be shared, but it is important to note that there are large numbers of permutations on the arrangement – e.g. the owner pays vet costs and transport costs, or contributes to infrastructure costs. These have a significant effect on the relative returns, and are able to be calculated using the budget.

In Part I. "Profit-sharing – keeper", the keeper retains 60% of *gross* profit (which is the appropriate indicator because they don't incur capital costs). This is divided by the time in the fattening period to derive "Returns over fattening period" and labour input to derive "Returns to person days". While the household does not incur capital costs of the feeder, the division of profits means that the daily returns are lower than if the feeders were self-owned by the household. However, the returns are perhaps only 25% lower (e.g. Rp50,477 compared to Rp61,463), so can act as an effective way for capital-poor households to generate income and savings.

In Part J. "Profit-sharing – owner", the owner retains 40% of *net* profit (because they incur capital costs of buying the bull). It is assumed that the owner doesn't input any labour. This is simply divided by the cost of the feeder cattle (provided by the owner) to derive "Returns to capital". Note that includes the capital costs of the cattle, so is the equivalent of net yield. At 9.6% return on cattle in wet season, this is higher than bank savings rate and helps explain the high incidence of investment in contract fattening. Returns are, however only 3.7% in dry season (low growth rates) and can become negative under a range of growth and price scenarios.

BUDGET SUMMARY - over fattening period	Wet season - representative housheold	% of categgory	Dry season - representative househr
A. Main paramaters			
Cattle			
Number feeders in stock (head)	4		4
Days on feed (days)	170		170
Number fattened over year (head)	8		8
Weight entry to household (kg)	189		189
ADWG (kg / day)	0.4		0.2
Weight exit of household (kg)	257		223
Feed			
DM intake (kg/head/day)	6		4
Proportion FTL in diet	80%		40%
Prices			
Cattle purchase price (Rp/kg LW)	29,000		29,000
Cattle sales price (Rp/kg LW)	29,000		29,000
Opportunity cost of labour (Rp/day)	45,000		45,000
B. Revenues	**30,468,838**		**26,512,614**
Cattle sales (Rp/fatteneing period)	29,812,000	98%	25,868,000
Value of manure (Rp/fattening period)	556,838	2%	544,614
Sale of timber	100,000	0%	100,000
C. Costs (excl labour and capital costs)	**23,274,655**		**23,308,655**
Cattle purchase (Rp/fattening period)	21,924,000	94%	21,924,000
Non-labour feed and water costs (Rp/fattening period)			
FTL and improved grasses purchased	0	0%	0
Bran and other supplements	0	0%	0
Fuel and water	237,534	1%	271,534
Veterinary and additives	364,000	2%	364,000
Cattle marketing costs			
Purchases	224,000	1%	224,000
Sales	4,000	0%	4,000
Depreciation of FTL, kandang, water, motorbike, biogas invest	185,778	1%	185,778
Land contract fee for FTL	0	0%	0
Crop shading	335,342	1%	335,342
D. Gross profit (returns to capital, labour & management)	**7,194,183**		**3,203,959**
Per day over fattening period	**42,319**		**18,847**
Less capital costs, of which	1,938,169		1,499,689
Feeder cattle	1,753,920	90%	1,315,440
Capital investments	184,249	10%	184,249
E. Net profit (returns to labour & management)	**5,256,013**		**1,704,269**
Per day over fattening period	**30,918**		**10,025**
Less cost of family labour, of which	3,848,177		4,708,802
Capital investments	34,427	1%	34,427
Cattle purchase and sales	360,000	9%	360,000
Feed collection and water	2,497,500	65%	3,358,125
Kandang work	956,250	25%	956,250
F. Net profit (returns to management)	**1,407,837**		**-3,004,532**
Per day over fattening period	**8,281**		**-17,674**
G. Labour days over fattening period			
Family labour	**86**		**105**
Of which: Capital investments	0.8	1%	0.8
Cattle purchase and sales	8	9%	8
Feeding costs	56	65%	75
Kandang work	21	25%	21
Hours per day on cattle fattening	**4.0**		**4.9**
H. Returns to person days			
Returns to person days (excluding capital costs)	**84,128**		**30,619**
Returns to person days (including capital costs)	**61,463**		**16,287**
I. Profit-sharing - keeper			
60% keeper			
Returns over fattening period	4,316,510		1,922,375
Daily returns over fattening period	25,391		11,308
Returns to person days	50,477		18,371
J. Profit sharing - owner			
40% owner			
Returns over fattening period	2,102,405		681,708
Returns to capital	**9.6%**		**3.1%**

Figure 11. Budget summary for Oebola

3.3.7 Scenarios

Within the basic structure of the budget, there are a very large number of variables and scenarios that could be examined. It is not possible to examine all of these, but the main or most important identified by research partners are shown in

BUDGET SUMMARY - scenarios	Dry season - representative household	Wet season - representative housheold	Wet - best performing	Wet - worst performing	Wet - price incresae 15%	Wet, price decrease 15%	Wet - 240 d
A. Main paramaters							
Cattle							
Number feeders in stock (head)	4	4	4	4	4	4	
Days on feed (days)	170	170	170	170	170	170	
Number fattened over year (head)	8	8	8	8	8	8	
Weight entry to household (kg)	189	189	189	189	189	189	
ADWG (kg / day)	0.2	0.4	0.8	-0.2	0.4	0.4	
Weight exit of household (kg)	223	257	325	155	257	257	
Feed							
DM intake (kg/head/day)	4.1	5.6	6.4	4.3	5.6	5.6	
Proportion FTL in diet	40%	80%	80%	80%	80%	80%	
Prices							
Cattle purchase price (Rp/kg LW)	29,000	29,000	29,000	29,000	29,000	29,000	2
Cattle sales price (Rp/kg LW)	29,000	29,000	29,000	29,000	33,350	24,650	2
Opportunity cost of labour (Rp/day)	45,000	45,000	45,000	45,000	45,000	45,000	4
B. Revenues	**26,512,614**	**30,468,838**	**38,363,979**	**18,626,126**	**34,940,638**	**25,997,038**	**33,95**
Cattle sales (Rp/fatteneing period)	25,868,000	29,812,000	37,700,000	17,980,000	34,283,800	25,340,200	33,06
Value of manure (Rp/fattening period)	544,614	556,838	563,979	546,126	556,838	556,838	79
Sale of timber	100,000	100,000	100,000	100,000	100,000	100,000	10
C. Costs (excl labour and capital costs)	**23,308,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,61**
Cattle purchase (Rp/fattening period)	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	21,92
Non-labour feed and water costs (Rp/fattening period)							
FTL and improved grasses purchased	0	0	0	0	0	0	
Bran and other supplements	0	0	0	0	0	0	
Fuel and water	271,534	237,534	237,534	237,534	237,534	237,534	33
Veterinary and additives	364,000	364,000	364,000	364,000	364,000	364,000	39
Cattle marketing costs							
Purchases	224,000	224,000	224,000	224,000	224,000	224,000	22
Sales	4,000	4,000	4,000	4,000	4,000	4,000	
Depreciation of FTL, kandang, water, motorbike, biogas i	185,778	185,778	185,778	185,778	185,778	185,778	26
Land contract fee for FTL	0	0	0	0	0	0	
Crop shading and moisture	335,342	335,342	335,342	335,342	335,342	335,342	47
H. Returns to person days							
Returns to person days (including capital costs)	**16,287**	**61,463**	**158,915**	**-71,896**	**118,883**	**14,298**	**7**

Figure 12.

For brevity of reporting, only the parameters that are adjusted and a single indicator of profitability – returns to person days (including capital costs) – are reported.

Weight gain

As shown above, there are large differences in the profitability of feeding in wet season compared to dry season for the representative household. By far the most important determinant is the difference in ADWG (0.4kg/day vs 0.2kg/day) due to diet and compensatory weight gain leading into wet season. The labour cost in collecting native grasses and leaves in dry season is slightly higher than collecting FTL leaves in wet season. The difference in ADWG leads to returns to labour of Rp61,463 in wet season, more than three times the returns (Rp16,287) in dry season.

These patterns are maintained for outliers in project cattle fattening group. The best performing households in the group in wet season (0.8kg/day) recorded very high returns (Rp158,915), while the lowest (-0.2kgs/day) operated at a heavy loss (Rp-71,896).

Prices

Profitability is also sensitive to price alignments and trends. Prices of feeder cattle may increase relative to the price of finished cattle in several cases:

- There is an upward movement in the broader cattle market over the fattening period (due to market or policy drivers)
- If households are able to source cheap cattle, for example: when many households are selling cattle for school fees; when exporters are not buying (due to shipping constraints); or because cattle look skinny (but still fatten well).
- If households are able to time their fattening regimes so that they sell cattle at peak prices (e.g. ceremonies, peak export demand with allocation of quota etc.

If finished cattle prices are 15% higher than feeder cattle prices then (compared to the representative household), returns increase by 75% to Rp118,883. However, prices decreases of 15% over the period will have the converse effect, meaning that returns to cattle fattening will be just Rp14,298. Cattle fattening households are susceptible to price risks under any number of cases including:

- Downward movement in the market over a fattening period (due to an over-heated market), for policy reasons (e.g. domestic or international quota allocation) or shocks (e.g. food safety).
- If farmers enter into a forced sale (due to feed or water availability, cash requirements or other household circumstances)

Time on feed

Another variable of interest to partners is the effect of time on feed on profits. The effects that are able to be modelled are only minor because the broader project only collects averaged, linear weight gain data. If the weight gains are the same within a season (e.g. wet or dry season) then changing the time period (e.g. 90 days or 180 days) will not impact on revenues per day.

However, feed supply and weight gains increase over wet season so from a productivity perspective farmers have an interest in keeping cattle over the highest gain months. In contrast, feed supply and weight gains decrease over the dry season, so farmers have an incentive to destock in those months. These assumptions do not however take into account: the effects of adaptation or compensatory weight gain (although these can counteract each other); and that farmers can sometimes buy good value cattle out of season (i.e. cheaper cattle during dry season). Reliable data is not available to test these effects.

The budget is however able to calculate the differences in some costs over different fattening periods. If vet costs (vaccination, vitamins, medical checks) and marketing costs (e.g. search and transport costs) are incurred for every animal bought in, then unit costs (per head over the fattening period) will obviously be lower over longer fattening periods. These costs are significant. On the other hand, there can be small increases in the costs of feeding heavier animals over the additional fattening period (an average of 5.9kg/day vs 5.2kg/day, or 12%) and therefore more labour to collect the feed. However, the *fixed* costs of collecting feed (time and fuel to travel to the feed source) mean that the extra time to collect the extra feed is assumed to be half this (6%). Conversely, the lower feed intake of lighter cattle fed over 120 days (5.3kg/day vs 5.6) reduces feed collection slightly (only 2.7%).

If these variables are incorporated, then compared to the representative household that fattens for 170 days (returns to person days of Rp61,287), this makes fattening over 240 days more profitable (Rp72,377), and short term fattening over 120 days less profitable (Rp55,958).

Capacity utilisation

Another scenario is capacity utilisation. While the representative household holds four head in stock, as mentioned in Section 3.3.3, the kandang and other facilities is able to hold up to five head. If the household can afford or can fit in another animal, then the depreciation costs allocated to each animal is decreased slightly (from Rp185,778 to Rp149,219). Increasing the number of cattle from four to five head increases feed demand by 20%. Again, due to fixed costs, actual labour is assumed to increase by about half this (10%). Because of the large increase in revenue from the sale of the extra animal, the reduced depreciation costs, and only modest increase in feed/labour costs, then returns to person days increase substantially from Rp61,463 to Rp77,848.

BUDGET SUMMARY - scenarios	Dry season - representative household	Wet season - representative housheold	Wet - best performing	Wet - worst performing	Wet - price incresae 15%	Wet, price decrease 15%	Wet - 240 days	Wet - 120 days	Wet - 5 head on feed	Straw/grass based diet
A. Main paramaters										
Cattle										
Number feeders in stock (head)	4	4	4	4	4	4	4	4	5	4
Days on feed (days)	170	170	170	170	170	170	240	90	170	170
Number fattened over year (head)	8	8	8	8	8	8	6	11	10	8
Weight entry to household (kg)	189	189	189	189	189	189	189	189	189	189
ADWG (kg / day)	0.2	0.4	0.8	-0.2	0.4	0.4	0.4	0.4	0.4	0.2
Weight exit of household (kg)	223	257	325	155	257	257	285	237	257	214.5
Feed										
DM intake (kg/head/day)	4.1	5.6	6.4	4.3	5.6	5.6	5.9	5.3	5.6	5.0
Proportion FTL in diet	40%	80%	80%	80%	80%	80%	80%	80%	80%	0%
Prices										
Cattle purchase price (Rp/kg LW)	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000
Cattle sales price (Rp/kg LW)	29,000	29,000	29,000	29,000	33,350	24,650	29,000	29,000	29,000	29,000
Opportunity cost of labour (Rp/day)	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
B. Revenues	**26,512,614**	**30,468,838**	**38,363,979**	**18,626,126**	**34,940,638**	**25,997,038**	**33,950,275**	**27,983,579**	**37,933,547**	**25,534,375**
Cattle sales (Rp/fatteneing period)	25,868,000	29,812,000	37,700,000	17,980,000	34,283,800	25,340,200	33,060,000	27,492,000	37,265,000	24,882,000
Value of manure (Rp/fattening period)	544,614	556,838	563,979	546,126	556,838	556,838	790,275	391,579	568,547	552,375
Sale of timber	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
C. Costs (excl labour and capital costs)	**23,308,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,274,655**	**23,615,042**	**23,031,521**	**28,867,096**	**22,817,434**
Cattle purchase (Rp/fattening period)	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	21,924,000	27,405,000	21,924,000
Non-labour feed and water costs (Rp/fattening period)										
FTL and improved grasses purchased	0	0	0	0	0	0	0	0	0	0
Bran and other supplements	0	0	0	0	0	0	0	0	0	0
Fuel and water	271,534	237,534	237,534	237,534	237,534	237,534	335,342	167,671	237,534	118,534
Veterinary and additives	364,000	364,000	364,000	364,000	364,000	364,000	392,000	344,000	455,000	364,000
Cattle marketing costs										
Purchases	224,000	224,000	224,000	224,000	224,000	224,000	224,000	224,000	280,000	224,000
Sales	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	5,000	4,000
Depreciation of FTL, kandang, water, motorbike, biogas i	185,778	185,778	185,778	185,778	185,778	185,778	262,275	131,138	149,219	182,900
Land contract fee for FTL	0	0	0	0	0	0	0	0	0	0
Crop shading and moisture	335,342	335,342	335,342	335,342	335,342	335,342	473,425	236,712	335,342	0
H. Returns to person days										
Returns to person days (including capital costs)	**16,287**	**61,463**	**158,915**	**-71,896**	**118,883**	**14,298**	**72,377**	**55,958**	**77,848**	**8,392**

Figure 12. Budget scenarios for Oebola

Cost of capital

Capital costs are important for several reasons: cattle fattening is a capital intensive activity; capital costs are a significant item in assessing net returns; and because access to cash can be a significant obstacle or enabler of entry into cattle production and higher productivity systems. To assess the impacts various cash costs are used:

- As stated above, the representative household incurs an opportunity cost of capital cost on all items (cattle, kandang, equipment) at a savings rate of 8%, leading to returns to person days (including capital costs) in wet season of Rp61,463
- If capital costs increased to a commercial loan rate (13%) then the returns decline to Rp47,289.
- If the household loans at an effective rate of 6% (subsidised under KKPE) then returns increase to Rp66,591.

Cost of labour

- As stated above, one indicator of profit is "F. Net profit (per day over the fattening period)" that takes into account both capital and labour costs. In case where own labour is not valued, this may not be an accurate measure of profitability. However, in areas where widespread access to off-farm labour is available (e.g. construction, mining, services from economic activity), it is the most accurate indicator.
- The representative household incurs an opportunity cost of labour of Rp45,000, leading to "F. Net profit (per day over the fattening period)" of Rp8,281. This is higher than in most crop-livestock systems.
- If this increases to Rp60,000, then net returns are break even at Rp747. If farmers can consistently access work at this rate, they will question the attractiveness of cattle production
- If it increases to Rp70,000 (as in Sumbawa), net returns are negative at Rp-4,276. If farmers can consistently access work at this rate, they will begin to exit the sector (as is the case in countries with broad-based sustained economic growth).

Returns without FTL

This section attempts to compare returns to fattening without and with FTL, which may be of interest to project partners and policy-makers. This is not straightforward because there was effectively no specialised or commercialised cattle fattening in Timor without leucaena, and it is difficult to envision a biologically and commercially viable system (as shown below) based on native grasses, trees and straw. However, an attempt to simulate such as system is made below based on a series of assumptions:

- All parameters for the representative household in wet season were used (including prices of both feeder to fattened cattle of Rp29,000), with the following exceptions:
- The diet is based in improved grasses (80%), corn silage (20%). This would not be possible throughout the wet season (because harvest is at the end of the wet season) unless there preservation over long periods, or it was purchased in. While straw could be stored and used in dry season, insufficient quantities of grass would be available.
- Weight gains reduced to 0.15kgs per day. This is a generous assumption, given comparisons in various feed systems and locations (Quigley et al, 2009 p.79-80; and Quigley et al., 2014).

- The household incurs no costs or revenues for leucaena establishment or cutting, no collection costs and the there are no shading / moisture effects on rice and peanut production.
- The time collecting and chopping straw increases from 0.1 to 0.5 of an hour, and from one hour to 2.5 hours collecting grass and leaves.

In this case, “E. Net profits (excluding labour)” are marginal (Rp4,635 per day) and “F. Net profits (including capital and labour)” are negative (-20,219 per day). As can be seen in the budget scenarios for Oebola, *Figure 18. Budget scenarios Nyerot*“ H. Returns to person days” are very low at Rp8,392. This suggests that fattening is unviable without leucaena and the households have clear incentives to adopt leucaena-based fattening systems.

3.3.8 Revenues from alternative activities (corn)

To put revenues from cattle fattening into perspective, and to understand incentives for farmers to enter into the activity, this section briefly outlines yield from the main activity of corn. Budgets draw on but have been updated and extrapolated from Flewelling (2012). *Figure 13* budgets maize production in a household in Oebola with 1 ha of dryland maize in wet season, based on yield and price parameters in 2015 and 2016. Results suggest that returns to person days are comparable to cattle fattening in wet season. Like cattle, however, returns are sensitive to numerous factors. Much of West Timor had low yields in 2015/6 due to drought (and crop failures in the south) although yields in Oebola were only slightly below average. If leucaena is planted on the perimeter, yield losses from shading and moisture is assumed to be 10% (see above), returns to person days reduce from Rp76,703 to Rp67,048.

						Rate		
		Unit	Qty			(Rp/unit)		Amount
A	**Revenue (per maize area)**		2,000					**7,000,000**
	grain sold soon after harvest	kg	1,200	(e.g.maize grain)		3,500		4,200,000
	retained for use/sale during yr	total	800	(e.g.maize cob/silase)		3,500		2,800,000
								7,000,000
B	**Material Cost (per maize area)**							**1,225,000**
	Seeds/Seedlings	kg	20	lamuru		10,000		200,000
	Fertilizer	kg	50	NPK		2,400		120,000
		kg	150	UREA		2,000		300,000
		kg		Manure				-
		kg		other				-
	Farm chemicals	litre	7	Roundup		75,000		525,000
		litre		2 (herbicide)				-
	BASSAH	litre	2	insecticide		40,000		80,000
		Litre		2 (pesticide)				-
	Other Material Costs	unit		1 tools				-
		unit		2 tools				-
C	**Labor Cost (per maize area)**		**73**					**3,262,500**
	Land Preparation	md	20			45,000		900,000
	Planting	md	4			45,000		180,000
	Fertilizer	md	10			45,000		450,000
	Pesticide/Herbicide	md	2			45,000		67,500
	Weeding	md	4			45,000		180,000
	Irrigation	md						-
	Harvesting	md	10			45,000		450,000
	Post Harvest (threshing)	md	8			45,000		360,000
	Post Harvest (drying)	md	9			45,000		405,000
	Post Harvest (packaging)	md	6			45,000		270,000
	Other Labor Cost	md				45,000		-
D	**Other cost (per maize area)**							**214,000**
	Land rent/fees	unit						-
	Communication	unit						-
	Group contribution	kg	100			2,000		200,000
	Fuel/transport	kg	350			40		14,000
	Other	unit						-
E	**Returns including labour**							
	Costs (B+C+D)			Rp (per maize area)				**4,701,500**
	Revenue - cost (Rp/maize area)				Rp			**2,298,500**
	Revenue - cost (Rp/ ha)				Rp			**2,298,500**
F	**Returns to labour**							
	Costs (excluding labour) (B+D)							1,439,000
	Revenue - cost (Rp/maize area)							5,561,000
	Returns to person days							**76,703**

Figure 13. Maize budget, Oebola 2015/16

4 NTB

4.1 Value chains

This section sketches out the value chain structures in NTB (Lombok and Sumbawa) structured around the generic value chain map presented above in *Figure 7*.

Some of the key production areas and infrastructure in Lombok is shown in *Figure 14*.

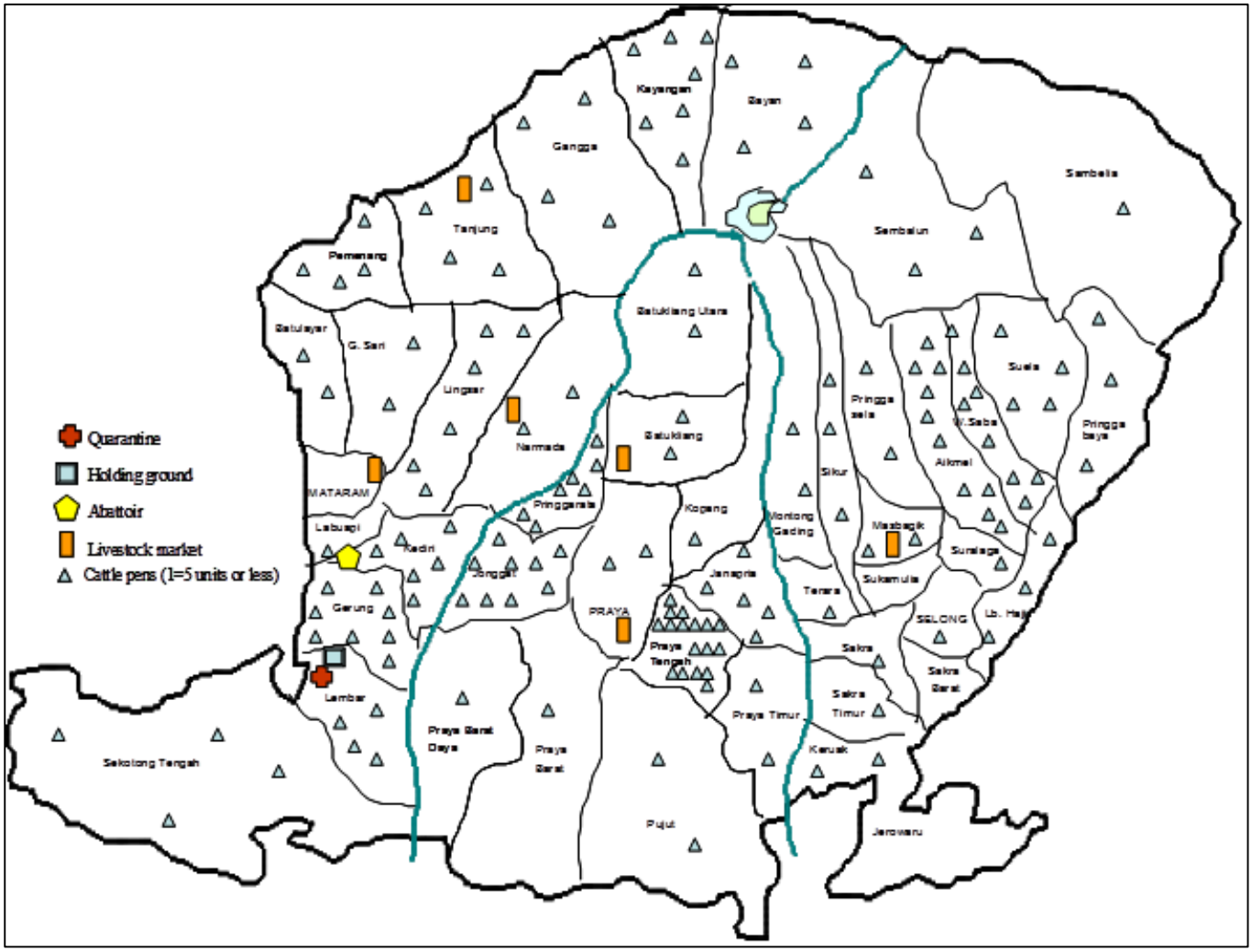


Figure 14. Distribution of cattle collective housing in Lombok

Source: Dahlanuddin et al. (2008)

4.1.1 A. Inputs

A1. Breeding

Bali cattle account for 98% of all beef cattle in NTB (MoA and BPS, 2011). This is partly due to policy that restricts breed choice, although Dinas NTB have considered relaxing this. The vast majority of breeding in NTB is done by natural mating. Bulls come form from own herds and from others in the village, while there are also cases of communal bulls run by cattle production groups. This structure has been used by project partners in some groups to improve genetics but also to generate income for the group (on sale of the bull).

Official figures suggest that there were 8,000 AI services in 2010 (BPS NTB, 2011) and there were 170 AI agents in NTB (Dinas employees or independent), about 75% of which are in Lombok. AI coverage is low even in Lombok. The risks associated with running an AI network – managing the bull station, semen distribution and liquid nitrogen network and providing timely services – and risks in introducing genetics with higher physiological (feed) demands – mean that natural breeding with Bali bulls is the best strategy (AS2/2000/103 and LPS/2008/038).

4.1.2 A4. Finance

Bank structures and lending for fattening outlined for NTT above (Section 3.1.3) are similar to those in NTB. For KKPE loans, branches are allocated subsidised funding from the bank, which sets the total funding available under the program, and branches set targets for lending it out. For the Sumbawa District branch of BRI, the allocation was Rp5 billion, which has been exhausted and targets met, so have applied for additional allocation (up to Rp7.5 billion) by transfer from other branches.

Like BRI NTT, the loan rate for KKPE is 13.75%, of which government subsidises 7.75%, leaving an effective loan rate of 6%. The maximum loan size for a group is Rp500 million for groups and Rp100 million for individual farmers. The bank prefers not to deal in very small loans because of the transaction costs. Branch lending can be used for a range of cattle fattening activities, and has been loaned out for cattle purchase (76%), kandangs (5%), feed/leucaena (14%) and vet and other costs (5%).

The bank bears the full risk of the loans. Liquidity comes from the bank and other institutions will not under-write the loans under the scheme. In the past, the subsidised capital was forwarded to branches before loans are made, but was said to now be transferred after loans have been made.

The lending principles and criteria applied are:

- “Character” – previous loans and track record.
- For agricultural production, BRI prefers that clients do not to have current loan with another bank (so they are not taking out a loan to pay another loan).
- Need to have an established farming system (e.g. feed and a kandang for fattening) and preferably established sales channels.
- Total loan term is 36 months, but have to pay based on production cycles – e.g. a fattening cycle of six to eight months. The loanee pays principle and interest. Profits from the activity can used to reduce the principle
- The bank secures the loan with collateral of at least 120% of the loan value. To overcome lack of collateral, a group loan can be made secured against collateral (e.g. the land certificate) of some of the households. Repayments then become the joint liability of the group under the “tanggung renteng” system. However, the bank prefers to deal with individual farmers to avoid group “dynamics”.

Documentation to assess the loan includes:

- Recommendation from the head of village and Dinas Livestock about the experience, technical capacity and assets of the loanee.
- Cattle identification and proof of ownership.

- Proposal on what the money will be used for – e.g. kandang, forage, cattle. Can include a budget of costs and revenues.
- Identification certificates of the farmer and wife (family card).
- Land certificate (if available).
- Receipts of cattle sales from buyer (if available, this is not usually collected) or proof of proceeds from sales through bank receipts from the (even if withdrawn the next day).
- It is also preferable if a loanee (group or individual) opens a deposit account linked to the loan. Interest from the deposit can be used to pay down the loan, and bank has a record of transactions.

There are a number of ways that support can be provided through activities and partnerships. The bank and other partners can provide training and assistance with farm and finance management. They encourage relationships between the bank, farmers, company, Dinas Livestock and research organisations (including BPTP and universities) to provide technical support and expertise.[9]

Banks loans have been made to two households in Jati Sari, and the effects on profitability are explored in Section 4.4.7.

4.1.3 B. Production

Production systems in NTB are highly variable. At the most intensive end of the scale, areas like Central Lombok have small land areas (e.g. 0.2 ha) with up to three crops per year. Small numbers of cattle (2-4 head) are raised within the integrated crop-livestock systems, although tree forages (sesbania) planted on bunds allow for commercial fattening. There are well-developed marketing systems in Lombok, high local consumption and no exports of slaughter cattle, and high prices (commensurate with Java).

Systems are more extensive in Sumbawa, with generally more land available for grazing and cropping (but with one to two crops per year). Average herd sizes are larger, predominantly in cow-calf production and mixed (cow-calf and fattening) systems. There are no commercial feedlots in NTB (although this was planned by the Meat Business Centre in Lombok), but a household fattening sector is emerging that can be described as increasingly specialised and commercialised. The majority of cattle turned off are exported live.

DGLAHS (2011) reports that there are 165,000 farmers in NTB that raise livestock. Statistics are not kept on the number of farmers that raise cattle specifically, but based on cattle numbers and an average of four head per household, there were around 196,000 farmers in 2011 that raise cattle, a similar number to that stated by the Government of NTB (2009). NTB had aggressive plans to expand cattle numbers and production (to 344,000 farmers) but this may have changed in the sharp downward revision of cattle numbers in the Agricultural Census of 2013 (see Section 2.3).

[9] The banks cited a model for corn where a lot of low-interest capital is available to promote the corn self-sufficiency policy. In the past, a mill used to forward money (informally) to farmers to buy inputs. The parties entered into an arrangement where a BRI bank account was established, guaranteed by the mill, from which farmers withdraw money, and repay through supply of grain. This “standardises: and formalises the financial arrangement.

4.1.4 C. Cattle marketing

Like NTT, cattle marketing systems are dominated by "spot" marketing and a hierarchy of brokers, dealers and butchers. There are large numbers of actors that operate on small margins and markets are generally competitive, efficient and "thick". Like NTT, however, there are some concentrated structures (oligopolies) at the end of the live export chain, especially for breeding cattle.

C3. Cattle markets. Compared to NTT, there are smaller distances and higher cattle population densities that have led to the establishment of more market places, especially in Lombok. Officially, there are nine markets in NTB. Seven are on Lombok (one West Lombok, one North Lombok, two Central Lombok, two East Lombok, and one in Mataram), one of which will be open on any given day. There are two markets on Sumbawa Island (Sumbawa and Dompu). However, some of the markets are not functioning or operate only intermittently.

4.1.5 C5. Inter-regional export

The absolute number of cattle exported from NTB (37,536 in 2013) are smaller than for NTT (56,000). Exports accounted for 43% of turnoff in NTT in 2013, and 33% in NTB.

However, unlike NTT, NTB (especially Lombok) exports females – 16,743 head in 2013, nearly as many as slaughter cattle (20,793). Because of its favourable disease status (free of brucellosis), breeding females can be exported to other islands / provinces from Lombok (15,000 head) and parts of Sumbawa where vaccination programs have been carried out (1,793 head).[10] The export of females is managed by quota and provincial standards (age, height, prices).

Lombok exports insignificant numbers of slaughter cattle because of the high local demand in the butcher market. However, there is a large trade of live cattle from Sumbawa Island to both Lombok and outside NTB. The live cattle export is also managed by quota. Export numbers (for both slaughter and breeding cattle) from NTB from 2001 to 2013 are shown in Figure 2.3. A snapshot of the district breakdown for slaughter cattle is shown in *Table 4*.

Table 4. Slaughter cattle exports from NTB, 2014

Export island / district	Quota	Exports from Sumbawa to Lombok	Exports outside NTB	Total exports	Unused quota
Lombok Island	2,000	-	603	603	1,397
Sumbawa Island	45,470	24,526	19,952	44,478	992
Sumbawa Barat	3,985	3,985	-	3,985	-
Sumbawa	18,235	13,085	5,150	18,235	-
Dompu	7,750	5,841	1,909	7,750	-
Bima	14,900	1,615	12,521	14,136	764

[10] Lombok is also free of Hemorrhagic septicaemia while Anthrax is virulent but free of cases.

Bima	600	-	372	372	228
Total NTB	47,470	24,526	20,555	45,081	2,389

Source: Dinas Livestock NTB, 2015 (unpublished document)

Traders

This section provides insights into the structures and conduct in the export sector based on information from government and traders in Sumbawa District is provided below.

In Sumbawa District there are 20 companies (traders) with a licence to export. However, there are limits on the numbers of cattle that can be exported, partly to "manage" herd structures and partly to alleviate pressure on inspection, quarantine and infrastructure and staff. For cattle, four companies can send by ferry one truck holding a maximum of 15 cattle. There are notionally weight limits (250kgs, 3yo) but these are not enforced. Quarantine processes are:

- Cattle are inspected at holding grounds at Dinas Livestock, which take blood samples, check ID of cattle (ownership etc.) and vaccination certificates (SE, anthranx). If the cattle don't have certificates, they are vaccinated at the holding area. All cattle are tagged.
- Cattle are then move to a different quarantine area (of Quarantine (two kilometres away), a different line agency) where cattle are held for at least one night. Holding times are longer from export to Surybaya because it takes longer to aggregate larger lot sizes.
- Costs is Rp35,000 / night / head including water and checks, paid by traders.

The largest trader in Sumbawa District (**Samsull**) trades about 100 head per day, bought through about 15 "middlemen" from two sub-districts in Sumbawa (Labanka and Taliwang). Samsull buys a range of cattle, to different "standards" for different markets. He has three trucks so can negotiate the transport cost (or incorporate into the purchase cost). No emptying out. Scales not used. Other features of the trade are:

- The lot size to Jakarta (through Surabaya) is 70 head and total costs of roughly Rp400,000 per head.
- A lot to Lombok is easier to aggregate (15 head, 200-330kgs) but costs more per head because of the small lot size – about Rp550,000. Cattle can be sold directly to Lombok traders but this isn't as profitable.
- Costs to Kalimantan were are abourRp150,000 per head
- He also has a contract to sell to the new abattoir in Sumbawa Barat (Taliwang)

There is a lot of seasonality in the trade:

- Can't trade to Jakarta after January until April because of the weather
- Prices increase from July to December (e.g. Rp5 million per head), but prices increase for festivals (Mohammed's birthday and Lebaran, e.g. Rp6.5 million)

Another smaller trader (**Ashari**) aggregates two trucks of 15 head per week for sale to Lombok, through a business partner there. Injuries are common (up to one head per truck). He backloads with vegetables and other items. The ferry to Lombok runs all year.

4.1.6 D. Slaughter

Like NTT, the vast majority of slaughter occurs in municipal service slaughterhouses, conducted by butchers (jagal) operating in small crews. Unlike NTT, statistics are not reported on the number of slaughterhouses in NTB. However dated statistics (The Government of NTB, 2009) record that NTB has one certified provincial level slaughterhouse and 41 certified district and sub-district slaughterhouses (two in Mataram, four in west Lombok, one in north Lombok, five in central Lombok, nine in east Lombok, two in Sumbawa Barat, nine in Sumbawa,[11] five in Dompu, three in Bima and one in Kota Bima). In addition, there are large numbers of cattle slaughtered in uncertified plants. In the case of Mataram City in NTB, uncertified slaughtering was estimated at 25% of certified slaughter (Hermansyah and Mastur, 2008).

Government and business have, however, sought to develop a more modern slaughter sector, where plants use slaughter lines and take ownership of cattle.

Banyumulak abattoir (Meat Business Centre). The plant located on the outskirts of Mataram (West Lombok) has been developed by the government of NTB (and contracted to a management company called PT Gerbang). This involved renovation of the JICA-built abattoir to include a slaughter line, cold facilities and cattle holding facilities. It falls under the umbrella of the Meat Business Centre, designed to be integrated with a feed mill, composting plant and fattening operations, and to link with households for cattle supply. The abattoir and associated operations are no longer operating or operating well under capacity.

RPH Bangkong Sumbawa is the largest abattoir in Sumbawa, located 10kms outside of the capital Sumbawa Besar. It was renovated from an older plant on the site, in 2013 and consists of holding yards, a large open slaughter room, an unmechanised slaughter line, concrete walls, open from top of walls to roof, separate rooms for offals, butchering etc. good drainage / water, no cold storage. The plant is run by Dinas Livestock as a service slaughter plant for 17 butchers (14 active) that slaughter one to two head per day each.

RPH Pototano. There has been significant development in the abattoir sector in Sumbawa Barat with the development of RPH Pototano. The abattoir has investment from district government and central government, and is managed by a company from Jakarta (Dharma Raya Hutamajaya? – Dahlan / tanda pls confirm). All product is sold to one company in Jakarta under the brand name Herbeef or (in English) Sumbawa Grass Beef.

The plant has a slaughter capacity of around 20 head per day (although it has slaughtered up to 26 head). It consists of cattle holding facilities, slaughter cradle and a slaughter line that leads into a boning and packing / cryovac facilities. There are three cold storage rooms, one hanging room (in quarters) and a blast freezer. The plant has 14 workers total that work throughout the line (not specialised roles).

The policy aim of the development is to displace live cattle export, and to do more “value adding” locally for export. The plant is not permitted to sell beef product locally. It also aimed to link with

[11] Dinas Livestock in Sumbawa say there are seven slaughterhouses in Sumbawa District, one of which is “large”. Slaughter is said to be 50% cows and 50% bulls.

many (up to 1,000) households which, it is planned, would be incentivised by high prices to increase cattle numbers, productivity and incomes.

The venture faces several challenges, especially in securing supply of cattle to specification at viable prices. If slaughtering 20 head per day, the abattoir would require 7,300 head per year to operate at full capacity. The abattoir said that it has a catchment area of around 80kms from Taliwang, which incorporates Sumbawa Barat and a part of Sumbawa district, but can extend further if cattle are available. Officials statistics presented in *Figure 15* provide some indication of the numbers of cattle that might potentially be available.

	Cattle numbers				**Reported slaughter**				**Slaughter cattle exports**			
	2011	**2012**	**2013**	**2014**	**2011**	**2012**	**2013**	**2014**	**2011**	**2012**	**2013**	**2014**
Sumbawa Barat	41,536	54,393	59,507	84,613	1,098	5,290	2,692	3,766	2,500	4,450	5,254	3,985*
Sumbawa	156,797	197,141	215,675	106,992**	4,533	2,090	5,619	6,309	9,659	12,350	18,165	18,235

Figure 15. Cattle supply in Sumbawa Barat and Sumbawa Districts, 2014

Source: BPS NTB (2014) and Dinas Livestock NTB (unpublished trade statistics)

Figure 15 suggests that the abattoir would have to buy virtually all of the cattle turned off in Sumbawa Barat in 2013-5 (slaughter + export) to operate at capacity. However, almost double the number of cattle from Sumbawa Barat in 2011 and 2013 were exported. Export numbers in 2014 were restricted by a lower quota (of 3,985 head, see astrix * in table) as local officials seek to build the local herd.

In addition to limits to supply from Sumbawa Barat District, there are also limits to supply from Sumbawa District:

- Cattle can be sourced from Sumbawa District (as far as the Dompu border) but distances can be significant and roads poor
- All exports from Sumbawa – including to the abattoir in Sumbawa Barat – is subject to the district quota (although there are some informal exports)
- There are also some statistical anomalies in Sumbawa (indicated by ** in the table), where cattle numbers were halved between 2013 and 2014, even higher than the 35% downward revision of cattle numbers in NTB in the agricultural census of 2013.

As a result of difficulties in accessing cattle at the initial minimum weight limit of 300kg, the limit was reduced to 250kg.

The ability to secure (already tight supplies of) cattle, depends on the ability of the abattoir to pay higher prices than competitors namely: local butchers; and live cattle exporters for butchers. The prices that the abattoir can viably pay for cattle – which typically makes up 70-80% of all abattoir costs – depend on cost structures and the output (beef) prices that can be achieved. Slaughter costs for abattoirs with a slaughter line are much higher than for butchers,[12] even with quarantine, shipping and trucking costs in export markets. Thus, the plant has to achieve significant price premiums for the Sumbawa Grass Beef product compared to generic beef of butchers. The strategy

[12] For a comparison of costs differentials between butchers and an abattoir with a slaughter line, see Waldron *et al.* (2012, Section 3.5.1). For abattoir budgeting see Waldron (2010) and Waldron et al (

to do this was through the marketing and sale of natural, organic beef, with health benefits (e.g. unsaturated fat and Vitamin E). Premiums could then be passed back to producers in the form of higher prices or better terms, which would further stimulate production and sales to the abattoir.

This may be achievable in the longer term but will clearly take some time and several iterations. The abattoir is reported to be operating well under capacity (about four to five head per day) due to lack of supply. The pricing schedule and terms used by the abattoir, and the way that this effects the choice of marketing channels for households are explored in 4.4.7 (Jati Sari).

4.2 Implications for cattle marketing and extension

Like NTT, spot markets in NTB are, in general, functioning and (at farm level) competitive. As such, there don't appear to be any major value chain interventions that will bring about large gains, although incremental gains may be possible.

This is especially the case as the major abattoirs in Lombok and Sumbawa (and Kupang) that operate at scale and take ownership of cattle are still trying developing a viable business plan and structures. If and when they can afford to pay price premiums for fattened cattle, then they may be an attractive sales channel for fattening households.

In the meantime, the obvious "lead actors" and potential agribusiness partners for marketing and extension purposes are cattle exporters. Major exporters or their representatives (associations) could be approached to discuss roles such as off-take agreements for specific types of cattle (through a wide catchment area) and extension activities through trader networks (training, dissemination of information etc.).

There also appear to be several bottlenecks in live cattle export chains.

- There is an oligopoly in the breeder cattle export market in Lombok, but less concentrated structures for slaughter cattle.
- In Sumbawa, the standard of facilities and feeding practices in holding and quarantine yards can be low, and result in weight loss. Replication of activities in holding and quarantine due to institutional division increase costs for exporters. Shipping can be risky (death and injury) and rudimentary feeding and watering practices result in weight loss. Costs are ultimately relayed back to farmers in the form of lower prices. The benefits of improved facilities and processes in holding and shipping have to be weighted up against the extra costs and the competitiveness of improving this infrastructure.

Several issues also arise in early stages of supply chains that directly affect farmers.

- Supply chains for both butchers and live export can be long, with numerous transactions along the chains. This however, is a way of managing trust and low capital formation along the chain and alternative systems (e.g. direct sales by farmers) entails its' own set of problems.
- Farmers lack direct and formal information in buying and selling cattle. Farmers do not enter physical marketplaces (they sell through brokers), there are no *formal* price reporting (but there are multiple informal channels) and scales are rarely used. However, the absence of information from these sources do not appear to result in low prices for producers or excessive margins for intermediaries. Both farmers and traders report that farmers in all sites (especially Jati Sari and Nyerot) have become increasingly skilled and at buying and selling cattle, including in estimating growth potential, body and carcass weight, the timing of sales in the year and in negotiating with

both sellers and buyers. Traders have reported that the years of windfall gain in buying from these groups are over.

- As shown in the budgeting below, prices levels and price alignments (between feeder and fattened cattle prices) have a large impact on returns. Farmers complain of a lack of information and knowledge about market trends over both the short and long terms. Uncertainty derives from a dynamic market, social and weather factors and especially government policy (e.g. international and domestic trade quotas and cattle distribution programs). A system to provide some understanding or forecasts would – if done accurately – provide some benefits to producers, but there also a range of obstacles, costs and risks in establishing such a system.

Finance. Interviews with farmers and results from household budgeting below suggest that access to (subsidised) incentivises farmers to enter into expand cattle fattening. Lower capital costs have a significant effect on net returns to fattening. Interviews with banks suggest that they are seeking to expand KKPE loans in particular for cattle fattening in areas, groups and households where technically sound and viable systems are established. Expansion of credit for fattening requires increased allocation of KKPE finance to branches where fattening is most developed or growing, and assistance to fattening groups and households to develop cattle production and management plans and to meet bank criteria.

4.3 Budget results Nyerot

4.3.1 Background

Budgeting here focuses on Nyerot Desa, Central Lombok District, Lombok, NTB. Nyerot has a population of 4,623 and 1,445 households (average three members per household). There are eight groups in the village. Data below has been collected through the project (Baiq T. Yuliana / Utie) based mainly on 2013 data, as well as in-depth focus groups and interviews with farmers in the group Pantang Mundur in 2015.

- Pantang Mundur has 82 households and 50ha of cropland. Between 30 and 40 households were monitored in the project.
- Cropping is the main activity, with three crops per year – rice-rice-soybean – used for own consumption, cash and residues used for feed.
- Households monitored have an average of 0.52 ha of land, but ranges from 0.15 to 1.5 ha, distributed over several plots.
- Sesbania and elephant grass is planted on bunds as a source of cattle feed.
- Cattle are integrated into the cropping system and not as a specialised activity. The number of cattle monitored ranges over year and month (e.g. 37 to 82 head in 2014).
- An average of two cattle per household are fattened over the year, but can range from one to nine.
- Farmers travel an average of just 200m to collected feed, but as far as four kilometres. Feed collected on foot (no motorbikes because of the plots and bunds etc.).

The village has raised cattle for generations, but focused more on cattle from 1984 when it built a collective kandang because of the benefits for security, building costs and hygiene. In the past, farmers raised cattle in a “traditional” way – primarily for draught purposes, low nutrition, with cows

making up around half the cattle in the kandang, and bulls fattened for long periods one or two years. A new collective kandang built in 2010 and successive projects have improved production systems.

The systems are described more below, but only the characteristics that are different to Oebola (Section 0) where the budget methods are described in more detail.

4.3.2 "Main parameters" sheet

The representative household in Nyreot has two head in stock for 150 days on feed. Pens are assumed to be empty for 65 days of year for cattle transition or cash shortages (but can easily be longer).

The regimes are:

- Wet season. Cattle are bought in at 187kgs, with an ADWG of 0.45kg/day based on a diet of 2.5% body weight comprised of 13% sesbania, 85% native grasses and leaves, and 2% rice bran.
- Dry season. Cattle are bough in at 165kgs, ADWG of 0.33kg/day based on a diet of 2% of bodyweight, comprised of 20% sesbania, 70% native grasses and leaves, 1% rice bran, and 9% peanut, soybean and other stover.

Cattle prices (Rp45,000/kg) represent average prices when visited in July 2015, and assumed to be the same (on a per unit basis) for feeder and finished cattle (this is varied in scenarios below). The opportunity cost of labour is Rp50,000 (but can be up to Rp70,000).

Predominant rice cropping, sesbania on bunds, communal fattening			2015 - Wet season	2015 - Dry season
Main parameters				
Biophysical				
	Cattle numbers			
		Cattle in stock (head)	2	2
		Days of year cattle in stock	300	300
		Cattle sold over year (head)	4	4
	Weight parameters			
		LW bought in (kg)	187	165
		Days on feed (days)	150	150
		ADWG (kg / day)	0.45	0.33
		LW sold out (kg)	254.5	214.5
		LW added over fattening period (kg)	67.5	49.5
		Average weight over period (kg/head/day)	220.75	189.75
	Ration (%)			
		DM feed intake as % of av body weight (%/day)	2.5%	2.0%
		FTL	13%	20%
		Improved grasses	85%	70%
		Native grass	0%	0%
		Straw / stover / silage	0%	9%
		Rice bran	2.0%	1.0%
		Other supplement	0.0%	0.0%
Market				
	Cattle prices			
		Cattle purchase price (Rp/kg LW)	45,000	45,000
		Cattle sales price (Rp/kg LW)	45,000	45,000
		Price difference	-	-
	Opportunity cost of labour (Rp/day)		50,000	50,000
	Capital costs			
		Interest rate for loans	6%	6%
		Interest rate on savings (opportunity cost own	8%	8%

Figure 16. Main parameters for Nyerot

Groups in Nyerot have accessed bank loans since 2005, with five annual rounds of loans for cattle. Households used the loan capital to buy different types of cattle – heavier cattle to turn over quickly for cash returns, and lighter animals that have longer fattening periods – the revenue from which is used to repay the loan over the full term over the loan. There haven't been loans since then (due to undisclosed problems of some kind). As result, the capital costs to buy cattle is assumed to be the savings rate (8%). This applies to all other capital costs, with the exception of the kandang, which was built in 2010 under KKPE (effective loan rate of 6%).

4.3.3 Capital investments

The design capacity for the kandang space of the representative household is two head, but because cattle may only be in the kandang for 300 days of the year, capacity utilisation is 82%.

For *sesbania establishment*, and to meet dietary requirements, the household requires 270 trees per animal (total of 540 for the representative household) with a 90 day cutting interval. This is planted on the bunds of the cropland. There are modest costs in establishing sesbania (mainly labour of five days), but the depreciation costs are higher than leucaena are higher because of the short depreciation period (four years).

A detailed budget of the communal kandang built in 2010 was conducted (available on request), and the costs allocated to individual households and depreciated over 20 years, and the 80 cattle fattened over the period. The kandang was built using a low interest loan (KKPE, so a loan rate of 6% applied) and required land lease costs. The group built a well at the same time of the kandang (with left over materials) so the costs are low and depreciated over 15 years. (However the well went dry in 2015 and other sources had to be used – including banana trunks). There are no biogas facilities. A hand drawn cart has been included in the inventory, used more than motorbikes in the village for feed collection.

Again capital costs on equipment and depreciation costs are small budget items (compared to cattle purchases). But with low capital formation and very intensive land use systems, installing the assets is a major consideration for farmers.

4.3.4 Production costs

Feeder cattle are expensive in Lombok (Rp45,000) and make up 96% all (non-labour and non-capital) costs.

Cattle marketing costs are incurred both on purchase of feeder cattle, and for sale (telephone, motorbike and transport costs of Rp56,000 each transaction). There are two markets nearby – Praya and Selegalas.

Like Oebola, the main *costs for feed* is in labour, which are lower in Nyerot because of the shorter distances and lower feed requirements. In wet (and dry) season, the representative spends 0.5 (0.75) of an hour collecting sesbania, one (1.25) hours collecting grasses, 0 (0.25) of an hour collecting straw/stover, 0.25 for water and 0.5 in the kanding. Unlike Oeobola, it is assumed that no motorbike fuel is used for collection.

When households mill rice, they often choose to retain (rather than sell) some of the bran. Even at a small percentage of the diet (2%), this equates to 50kgs per animal, worth Rp180/kg. This is a significant *cash cost*.

Veterinary and additive costs are assumed to be the same as Oebola, one medical check and a vitamin supplement, although these can sometimes be collapsed in a single service of an animal paramedic. Again, this is a significant *cash* outlay.

Crop shading and moisture reduction is included as another cost of production. When 0.5 ha of rice is planted twice per year, and 0.5 ha of soybean once per year, perimeter planting of sesbania reduces yields by 5% valued at Rp320,000 over a fattening period.

4.3.5 Revenues

98% of revenues derive from the sale of fattened cattle. While large amounts of manure are collected in the communal kandang, which has a “compost house” and a biogas pit, manure is not used and flows down a slope to a nearby field.

The sale of timber from sesbania is significant, accounting for 2% of revenues. Trunks cut every four years (from 540 trees) can be sold (cut and dried) for Rp10,000 each.

4.3.6 Returns to cattle fattening

Subtraction of costs from revenues provides gives “D. Gross profits” of Rp36,994 per day in wet season and Rp26,194 in dry season. These are modest returns. However, capital costs and labour input for the small-scale operation is also low. Even after the market rates for these costs are deducted, “F. Net profits (returns to management)” are still positive in wet season (Rp11,971 per day), and break-even in dry season (Rp-633).

Because fattening of the two cattle only takes modest labour input (“F” – 2.4 hours per day in wet season, 3.1 in dry season), then returns are healthy when converted to an eight hour day basis. Returns to cattle fattening in wet season (Rp89,938 equivalent per day) are double that of the average daily off-farm wage (Rp50,000 per day). Dry season returns (Rp48,390) are comparable.

In owner-keeper relationships (where the value added from weight gain are distributed on a 60:40 basis and all other costs are shared) the results are similar to Oebola, and seem mutually advantageous, even in dry season (ADWG of 0.33kg/day) where returns are still healthy. However, changes to the arrangement have a large effect on returns (e.g. if profits are split 50:50 or if vet and marketing are bourne by one party more than another).

BUDGET SUMMARY - over fattening period	2015 - Wet season	% of category	2015 - Dry season	% of category
A. Main paramaters				
Cattle				
Number feeders in stock (head)	2		2	
Days on feed (days)	150		150	
Number fattened over year (head)	4		4	
Weight entry to household (kg)	187		165	
ADWG (kg / day)	0.45		0.33	
Weight exit of household (kg)	255		215	
Feed				
DM intake (kg/head/day)	6		4	
Proportion FTL in diet	13%		20%	
Prices				
Cattle purchase price (Rp/kg LW)	45,000		45,000	
Cattle sales price (Rp/kg LW)	45,000		45,000	
Opportunity cost of labour (Rp/day)	50,000		50,000	
B. Revenues	**23,459,795**		**19,859,795**	
Cattle sales (Rp/fatteneing period)	22,905,000	98%	19,305,000	97%
Value of manure (Rp/fattening period)	0	0%	0	0%
Sale of timber	554,795	2%	554,795	3%
C. Costs (excl labour and capital costs)	**17,910,682**		**15,930,682**	
Cattle purchase (Rp/fattening period)	16,830,000	94%	14,850,000	93%
Non-labour feed and water costs (Rp/fattening period)				
FTL and improved grasses purchased	0	0%	0	0%
Bran and other supplements	180,000	1%	180,000	1%
Fuel and water	0	0%	0	0%
Veterinary and additives	178,000	1%	178,000	1%
Cattle marketing costs				
Purchases	112,000	1%	112,000	1%
Sales	2,000	0%	2,000	0%
Depreciation of FTL, kandang, water, motorbike, bic	288,134	2%	288,134	2%
Land contract fee for FTL	0	0%	0	0%
Crop shading	320,548	2%	320,548	2%
D. Gross profit (returns to capital, labour & management)	**5,549,112**		**3,929,112**	
Per day over fattening period	**36,994**		**26,194**	
Less capital costs, of which	1,505,374		1,072,913	
Feeder cattle	1,346,400	89%	891,000	83%
Capital investments	158,974	11%	181,913	17%
E. Net profit (returns to labour & management)	**4,043,738**		**2,856,199**	
Per day over fattening period	**26,958**		**19,041**	
Less cost of family labour, of which	2,248,082		2,951,207	
Capital investments	114,092	5%	114,092	4%
Cattle purchase and sales	200,000	9%	200,000	7%
Feed collection and water	1,512,115	67%	2,215,240	75%
Kandang work	421,875	19%	421,875	14%
F. Net profit (returns to management)	**1,795,656**		**-95,008**	
Per day over fattening period	**11,971**		**-633**	
G. Labour days over fattening period				
Family labour	**45**		**59**	
Of which: Capital investments	2.3	5%	2.3	4%
Cattle purchase and sales	4	9%	4	7%
Feeding costs	30	67%	44	75%
Kandang work	8	19%	8	14%
Hours per day on cattle fattening	**2.4**		**3.1**	
H. Returns to person days				
Returns to person days (excluding capital costs)	**123,419**		**66,568**	
Returns to person days (including capital costs)	**89,938**		**48,390**	
I. Profit-sharing - keeper				
60% keeper				
Returns over fattening period	3,329,467		2,357,467	
Daily returns over fattening period	22,196		15,716	
Returns to person days	**74,051**		**39,941**	
J. Profit sharing - owner				
40% owner				
Returns over fattening period	1,617,495		1,142,480	
Returns to capital	**9.6%**		**7.7%**	

Figure 17. Budget summary - Nyerot

4.3.7 Scenarios

Scenarios that related to time of feed and capacity utilisation have been addressed for the case of Oebola (Section 3.3.7) and the budget behaves the same way for Nyerot. This section concentrates on the main issues of weight gain, prices and labour costs

Weight gain

As could be expected, weight gain has a major effect on profitability. The effect of wet vs dry season feed resources, diet and weight gain is shown in *Figure 18*. Note that reported average weight gains in Oebola are high (0.4kgs/day in wet season and 0.33kgds/day in dry season).

The scenario "Wet season – best performing, higher inputs" uses the parameters of:

- An increase in ADWG from 0.4 to 0.8 kg/day ADWG.
- An increase in intake from 2.5% body weight to 3%.
- To provide the extra feed, the household buys rights to harvest 100 trees of another farmer in the village (Rp200,000 per cut) and 40sq m of elephant grass (Rp50,000 per cut). Labour to harvest this feed increases by 25%.
- The amount of bran in the diet increases from 2% to 5%.

In this case, the returns (to person days) increase by 40% to Rp145,191.

There are records of zero weight gain for cattle in Nyerot, in which case even gross returns are of course negative.

Prices

Short term prices vary significantly in Lombok due to a large number of factors. Prices can be driven down in conditions when farmers in Lombok (and Sumbawa) sell cattle to buy materials for planting, to pay for school fees or in dry conditions. Prices are high when there is high demand for cattle after harvest (cashed up farmers), when there are large export orders to fill or during festivals (Idul Fitri, Idul Adha, Prophet Muhammad birthday). Within a fattening period the relative prices of feeder cattle to fattened cattle can increase or decrease by significant amounts. These effects of price change (+/-15%) on returns (+/-15%) are shown for Oebola, which also hold for Nyerot.

Longer term price movements effects are explored further in this section.

- As established in Section 2.4, beef (and cattle) prices increased rapidly especially from 2012. The scenario "Low prices 2012" shows the effect of prices of Rp25,000 for both feeder and finished cattle, which halves returns (to Rp46,844 per labour day) compared to 2015 when feeder and finished cattle were Rp45,000.
- In reality, markets were so buoyant in 2012 that prices increased rapidly even over a single fattening period. Monitoring data shows that average feeder cattle prices increased by 31%. This increases daily returns to Rp134,123.
- Increasing prices in the period may have had two effects: cow-calf producers capitalised by selling cows or younger offspring; and feeding households entered the market or sought to increase production capitalise on the windfall profits. This may explain the increase in feeder cattle prices increased relative to fattened cattle. At the same time, producers were likely to be able to absorb the change in alignment while remaining profitable, especially if they could

increase efficiencies, albeit with smaller margins. That is, the cattle market is responding in a normal way. In developed beef cattle economies, as price levels and technical efficiencies increase, per unit cattle input prices are usually higher than output prices. In 2013, when feeder prices drew level with fattened cattle prices. Because of the lower overall prices levels, returns are 23% lower than the 2015 level.

- This trend continued in 2014 when the per unit price of feeder cattle was 2% higher than the price of fattened cattle. However this was offset by the overall increase in price levels, so led to returns of Rp77,585 per day.
- Data from household and trader interviews (not through monitoring data) show that this trend increased in 2105, when feeder cattle prices of Rp45,000 were 7% higher than fattened cattle prices (Rp42,000). Even with high general price levels, the alignment brings returns down to Rp62,951.
- At these price alignments, households that cannot achieve high weight gains will be unprofitable. Measured in terms of "F. Net returns", the break-even point is 0.4kg/day.
- It is also important to note that some households (estimated at 10%) of the group can regularly access off-farm work (carpentry) at a wage of Rp75,000 per day, similar to an average wage in Sumbawa. With feeder-fattened cattle price alignments of Rp45,000 to Rp42,000, and a labour cost of Rp75,000, producers need to achieve weight gains of 0.49 kg/day to break even (in terms of "F. Net returns").

Table 5. Effects of changing feeder-fattened cattle price alignments on returns to person days, Oebola 2012-15

			Feeder cattle			
			2012	**2013**	**2014**	**2015**
		Price (Rp/kg lw)	**25,117**	**34,314**	**41,342**	**45,000**
Fattened cattle	**2012**	**32,801**	134,123			
	2013	**34,467**		71,895		
	2014	**40,444**			77,585	
	2015	**42,000**				62,951

Note for Table 5: Prices for 2012-2014 are the average of recorded prices monitoring by field researchers in Oebola. Prices for 2015 were established through interviews in Oebola and market/trader visits. Returns to person days (Item H. in the budget sheet).

Returns without FTL

To cast a scenario of cattle fattening without tree forages:

- All parameters for the representative household in wet season were used (including prices of both feeder to fattened cattle of Rp45,000), with the following exceptions.

- The diet is based in improved grasses (70%), straw (28%) and bran (2%).
- Weight gains reduced to 0.2kgs per day (a generous assumption).
- The household incurs no costs or revenues for sesbania establishment or cutting, no collection costs and the there are no shading / moisture effects on rice and peanut production.
- Households spend an extra 0.5 of an hour collecting and chopping straw.

In this case, “E. Net profits (excluding labour)” are marginal and “F. Net profits (including labour)” are negative (-9,289 per day). As can be seen in *Figure 18. Budget scenarios NyerotFigure 18*, H. Returns to person days” are very low at Rp17,752. This suggests that households have clear incentives to adopt sesbania-based fattening systems.

BUDGET SUMMARY - over fattening period	2015 - Wet season	2015 - Dry season	2015 - Wet - best performing, purchase feeed	2015 - Dry - worst performing	2012 - low prices - feeder-finished prices	2012 - monitored	2013 - monitored	2014 - monitored	2015 - observed	Straw/grass based diet
A. Main paramaters										
Cattle										
Number feeders in stock (head)	2	2	2	2	2	2	2	2	2	2
Days on feed (days)	150	150	150	150	150	150	150	150	150	150
Number fattened over year (head)	4	4	4	4	4	4	4	4	4	4
Weight entry to household (kg)	187	165	187	165	187	187	187	187	187	187
ADWG (kg / day)	0.45	0.33	0.8	0	0.45	0.45	0.45	0.45	0.45	0.2
Weight exit of household (kg)	255	215	307	165	254.5	254.5	254.5	254.5	254.5	217.0
Feed										
DM intake (kg/head/day)	6	4	7	3	5.5	5.51875	5.5	5.51875	4.415	4.04
Proportion FTL in diet	13%	20%	13%	20%	13%	13%	13%	13%	13%	0%
Prices										
Cattle purchase price (Rp/kg LW)	45,000	45,000	42,000	42,000	25,000	25,117	34,314	41,342	45,000	45,000
Cattle sales price (Rp/kg LW)	45,000	45,000	42,000	42,000	25,000	32,801	34,467	40,444	42,000	45,000
Opportunity cost of labour (Rp/day)	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
B. Revenues	**23,459,795**	**19,859,795**	**26,342,795**	**14,414,795**	**13,279,795**	**17,250,507**	**18,098,647**	**21,140,569**	**21,932,795**	**19,530,000**
Cattle sales (Rp/fatteneing period)	22,905,000	19,305,000	25,788,000	13,860,000	12,725,000	16,695,713	17,543,853	20,585,775	21,378,000	19,530,000
Value of manure (Rp/fattening period)	0	0	0	0	0	0	0	0	0	0
Sale of timber	554,795	554,795	554,795	554,795	554,795	554,795	554,795	554,795	554,795	0
C. Costs (excl labour and capital costs)	**17,910,682**	**15,930,682**	**17,669,482**	**14,940,682**	**10,430,682**	**10,474,579**	**13,914,185**	**16,542,605**	**17,910,682**	**17,575,892**
Cattle purchase (Rp/fattening period)	16,830,000	14,850,000	15,708,000	13,860,000	9,350,000	9,393,897	12,833,503	15,461,923	16,830,000	16,830,000
Non-labour feed and water costs (Rp/fattening period)										
FTL and improved grasses purchased	0	0	600,000	0	0	0	0	0	0	0
Bran and other supplements	180,000	180,000	460,800	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Fuel and water	0	0	0	0	0	0	0	0	0	0
Veterinary and additives	178,000	178,000	178,000	178,000	178,000	178,000	178,000	178,000	178,000	178,000
Cattle marketing costs										
Purchases	112,000	112,000	112,000	112,000	112,000	112,000	112,000	112,000	112,000	112,000
Sales	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Depreciation of FTL, kandang, water, motorbike,	288,134	288,134	288,134	288,134	288,134	288,134	288,134	288,134	288,134	273,892
Land contract fee for FTL	0	0	0	0	0	0	0	0	0	0
Crop shading and moisture	320,548	320,548	320,548	320,548	320,548	320,548	320,548	320,548	320,548	0
H. Returns to person days										
Returns to person days (including capital costs)	**89,938**	**48,390**	**145,191**	**-26,081**	**46,844**	**134,123**	**71,895**	**77,585**	**62,951**	**17,752**

Figure 18. Budget scenarios Nyerot

4.4 Budget results Jati Sari

4.4.1 Background

Jati Sari is an area (below hamlet level), located in Poto Pedu Hamlet, Rhee sub-district, in the north of Sumbawa District. In Jati Sari, the project works mainly in Rhee Baru Village.

Jati Sari is a Balinese transmigration village, settled many years ago. The villagers started in aquaculture and other activities. The soil in the area is poor so yields are low. Thus, households moved into cattle production based in tree forages, initially as cattle keepers where they learnt skills and built up their own herds (there are still a few keepers in Jati Sari in the kadas system on a 50:50 basis). This was initially cow-calf production, but increasingly in fattening, and most households now do both. Villagers plant some corn and peanuts for own consumption. Rice and vegetables are bought in. Thus, Jati Sari is an example of an area that has increasingly specialised in FTL-based cattle fattening, unlike more diversified systems in Nyerot.

Households interviewed have an average of four cows that are free grazed and tethered in nearby grassy areas, and bought in to the village at night – tethered under tree. Female calves are usually sold or used as replacements, while males are kept for feeding. The feeder stock is supplemented by feeders purchased from outside markets where they select cattle with good conformation (frame, coat, horns, big heads etc.).

Leucaena has a long history in Jati Sari. It is alley-cropping on flat land, and also covers much of the hillsides, unfenced. This is cut and carried back to cattle fattening pens, which are owned and managed by individual households.

Jati Sari has:

- 4,611 ha. of land total in the village.
- 730 households and 2,769 (3.8 members per household).
- Four farmers groups.
- Amongst the households monitored, the average land size was 2.8 ha (range of one to five ha.).
- Households travel an average of 0.7km to collect leucaena (range of 0.1 to 1.5km).
- The average number of bulls fattened per year is 10 (range of three to 16).
- Of the 18 farmers monitored in the group, it turned off 238 bulls in 2014, at an average of 13 per year.

4.4.2 “Main parameters” sheet

Cattle production, purchase and sale regimes in Jati Sari are flexible and speculative, and producers tend to buy and sell cattle at light liveweights. This reflects the entrepreneurialism and knowledge of the producers but, as shown below, it also reflects the low transaction and production costs (buying and selling cattle, vet costs) as shown in Section 4.4.4.

- In wet season, average purchase weights in 2014 were 142kgs and sales weights were 197kgs, which at 0.5kgs liveweight gain per day is 148 days on feed.
- In dry season, average purchase weights were 142kgs and sales weights were 197kgs, which at 0.35kgs liveweight gain per day is 105 days on feed.

These weights are lower than (project) “target” weight for sales of 250kg, which is also the minimum weight for the export of bulls to Lombok (although this is not necessarily enforced and there can be on-feeding). While it is sometimes assumed that this is because of concerns about theft (which occurred in 2014), households and project staff cited other reasons: especially to turn over cattle quickly for cash flow; because they can achieve good weight gains and profits from buying cattle with good potential for weight gain; and because of favourable prices for light cattle for the jagal market.

Interviews and project staff suggest that households fatten more cattle in wet season (10 head) than dry season (three head), when cattle fattening is most profitable.

To account for the high turnover, it is assumed that there are relatively long periods (56 days) where pens may be empty.

Weight gains in Jati Sari are high – 0.5kg/day in wet season and 0.35kg/day in dry season – reflecting the skills, knowledge and resources of households. Furthermore, monitoring data suggests a relatively narrow range weights gains from a high of 0.6kg/day in wet season a low of 0.2kg/day in dry season.

Site monitoring data show that prices are below those of Lombok (due to the extra costs of trading and transport) and prices of feeder cattle are lower than those of fattened cattle in: 2012 (Rp21,469 - Rp26,457); 2013 (27,108 - 31,463) and 2014 (32,848 – 36,042). Prices when visited in July 2015 were around Rp37,00 for feeder cattle and Rp40,000 for fattened cattle.

From April 2015, fivee households in Jati Sari in two members in the group entered into a loan with BRI. In the group, the group leader entered into a loan for Rp40 mil group leader and another household for Rp20 million, both to buy feeders. The full cost of the loan under KKPE is 13%, but with subsidies the effective rate is 7%. Households in Jati Sari have land certificates, which they use for collateral. Other households “are watching” these cases before applying themselves.

Predominant rice cropping, sesbania on bunds, communal fattening				
			Wet season rep	Dry season rep
Main parameters				
Biophysical				
	Cattle numbers			
		Cattle in stock (head)	10	3
		Days of year cattle in stock	300	300
		Cattle sold over year (head)	20	9
	Weight parameters			
		LW bought in (kg)	131	153
		Days on feed (days)	148	105
		ADWG (kg / day)	0.5	0.35
		LW sold out (kg)	205	189.75
		LW added over fattening period (kg)	74	36.75
		Average weight over period (kg/head/day)	168	171.375
	Ration (%)			
		DM feed intake as % of av body weight (%/day)	2.5%	2.5%
		FTL	100%	60%
		Improved grasses	0%	0%
		Native grass	0%	0%
		Straw / stover / silage	0%	40%
		Rice bran	0%	0%
		Other supplement	0%	0%
Market				
	Cattle prices			
		Cattle purchase price (Rp/kg LW)	37,000	37,000
		Cattle sales price (Rp/kg LW)	37,000	37,000
		Price difference	-	-
	Opportunity cost of labour (Rp/day)		50,000	50,000
	Capital costs			
		Interest rate for loans	6%	6%
		Interest rate on savings (opportunity cost own	8%	8%

Figure 19. Main parameters for Jati Sari

4.4.3 Capital investments

The representative household in Jati Sari has a large number (3,000) leucaena trees in flat land (inter-cropped with maize) and sloping areas, unfenced, cut every 120 days.

A detailed budget was done on the cost of an individual household kandang in Jati Sari. Because of the large capacity (10 head), the costs are high – Rp6,560,000 for equipment and Rp1,700,000 in labour – depreciated over 20 years.

A motorbike is required, no cart of straw chopper, households dig and use their own well (which is expensive at Rp3 million) and no biogas facilities.

4.4.4 Production costs

Households in Jati Sari claim that they have low purchase and sales costs. For feeder cattle purchases, dealers can bring cattle out in a truck, or can inspect at a holding yard about 15kms away (incurring low phone, fuel and time costs). Transport was said to be organised / paid for by traders. Finished cattle are sold to five to six dealers that visit the village (so households don't incur transport costs). These dealers buy for nearby live exporters (see Section 4.1.5).

It is assumed that in wet season, the household spends long periods (twice a day to total three hours a day) collecting leucaena for 10 head. Under a *tabas* system, some households purchase leucaena on trees – for example one cut of 100 trees at cost of Rp200,000 – but this is not included for the representative household budget. Corn stover makes up 40% of the diet in dry season, when the households spends 1.25 hours per day feeding 3 head.

Veterinary practices in the group have been rudimentary, but farmers would commonly ask for the services of animal paramedics when sick and administer vitamins (Rp50-70,000 / dose once in fattening period). The project now pays for the costs of vitamins and deworming. No vaccinations are given, which is done by traders before export.

Because leucaena is alley-cropped into 2.5 ha. of corn, shading effects reduce yields by 30%, which is a significant (but worthwhile) cost incurred for all cattle fed over the year.

4.4.5 Revenues

In addition to feeder cattle, there are other small revenue items. Manure from pens is used on only nearby fields (assumed to be 30% of manure production) and the rest discarded. Households in Jati Sari commonly use (7,400!) leucaena branches for firewood over a fattening period, valued at Rp200,000.

4.4.6 Returns to cattle fattening

One of the features of Jati Sari is the high profitability of cattle fattening in wet season. This applies for "D. Gross profit", "E. Net profit (including capital costs)" and "5. F Net profit (including capital and labour costs)", which are positive (Rp95,682 per day). The high profits are primarily a result of high weight gains (0.5kgs/day). In addition, because large numbers of cattle are fed (10 head) there are economies of scale reflected in low (per head) cost of depreciation. There are also low cattle marketing costs. Households spend relatively long periods on cattle fattening (5.7 hours per day on 10 head), but even then "H. Returns to person days" are very high (compared to other regions) of Rp185,203. There are still owner-keeper relationships in Jati Sari, which are profitable on both sides.

Project data shows a major difference in the production systems and therefore budget results in wet and dry seasons. Most notably, growth rates are lower (0.35kgs/day) and households respond with much fewer animals (3 head) which increases per head overhead costs slightly.

BUDGET SUMMARY - over fattening period	Wet season rep	% of category	Dry season rep	
A. Main paramaters				
Cattle				
Number feeders in stock (head)	10		3	
Days on feed (days)	148		105	
Number fattened over year (head)	20		9	
Weight entry to household (kg)	131		153	
ADWG (kg / day)	0.5		0.35	
Weight exit of household (kg)	205		190	
Feed				
DM intake (kg/head/day)	4		4	
Proportion FTL in diet	100%		60%	
Prices				
Cattle purchase price (Rp/kg LW)	37,000		37,000	
Cattle sales price (Rp/kg LW)	37,000		37,000	
Opportunity cost of labour (Rp/day)	50,000		50,000	
B. Revenues	**76,083,613**		**21,269,548**	
Cattle sales (Rp/fattening period)	75,850,000	100%	21,062,250	99%
Value of manure (Rp/fattening period)	33,613	0%	7,298	0%
Sale of timber	200,000	0%	200,000	1%
C. Costs (excl labour and capital costs)	**52,205,206**		**19,642,717**	
Cattle purchase (Rp/fattening period)	48,470,000	93%	16,983,000	86%
Non-labour feed and water costs (Rp/fattening period)				
FTL and improved grasses purchased	0	0%	0	0%
Bran and other supplements	0	0%	0	0%
Fuel and water	0	0%	0	0%
Veterinary and additives	768,000	1%	217,500	1%
Cattle marketing costs				
Purchases	10,000	0%	3,000	0%
Sales	10,000	0%	3,000	0%
Depreciation of FTL, kandang, water, motorbike, bic	210,220	0%	494,437	3%
Land contract fee for FTL	0	0%	0	0%
Crop shading	2,736,986	5%	1,941,781	10%
D. Gross profit (returns to capital, labour & management)	**23,878,407**		**1,626,830**	
Per day over fattening period	**161,341**		**15,494**	
Less capital costs, of which	4,480,553		1,959,806	
Feeder cattle	3,877,600	87%	1,358,640	69%
Capital investments	602,953	13%	601,166	31%
E. Net profit (returns to labour & management)	**19,397,854**		**-332,976**	
Per day over fattening period	**131,067**		**-3,171**	
Less cost of family labour, of which	5,236,912		1,569,524	
Capital investments	27,537	1%	50,774	3%
Cattle purchase and sales	1,000,000	19%	300,000	19%
Feed collection and water	2,821,875	54%	825,000	53%
Kandang work	1,387,500	26%	393,750	25%
F. Net profit (returns to management)	**14,160,942**		**-1,902,499**	
Per day over fattening period	**95,682**		**-18,119**	
G. Labour days over fattening period				
Family labour	**105**		**31**	
Of which: Capital investments	0.6	1%	1.0	3%
Cattle purchase and sales	20	19%	6	19%
Feeding costs	56	54%	17	53%
Kandang work	28	26%	8	25%
Hours per day on cattle fattening	**5.7**		**2.4**	
H. Returns to person days				
Returns to person days (excluding capital costs)	**227,982**		**51,826**	
Returns to person days (including capital costs)	**185,203**		**-10,608**	
I. Profit-sharing - keeper				
60% keeper				
Returns over fattening period	14,327,044		976,098	
Daily returns over fattening period	96,804		9,296	
Returns to person days	**136,789**		**31,095**	
J. Profit sharing - owner				
40% owner				
Returns over fattening period	7,759,142		- 133,190	
Returns to capital	**16.0%**		**-0.8%**	

Figure 20. Budget summary - Jati Sari

4.4.7 Scenarios

Major scenarios (weigh gain, time on feed, capacity utilisation, cost of labour) have been explored in other areas (Oebola and Nyerot) and apply here.

Cattle sales channels

One scenario to explore in Jati Sari is the possibility of selling directly to the Pototano abattoir in Taliwang, Sumbawa Barat (see Section 4.1.6). The newly established abattoir needs increased cattle supply including outside Sumbawa Barat District. The abattoir buys from a catchment area of up to 80kms, which could include Jati Sari. If the abattoir buys cattle from Jati Sari through traders, it offers Rp52,000 per kg dressed weight (over-the-hooks) for the class of (light) cattle turned off from Jati Sari (189.75kg to 205kg liveweight). At a dressing percentage of 49% (for light cattle) this equates to just Rp25,480 per kg liveweight, and would be an unattractive option compared to prices of Rp37,000 in other channels.

If farmers sell direct to the abattoir, then there are additional payments for offal, hide, feet and head as outlined in *Figure 21*. Even including these additional payments, the abattoir prices (the equivalent of Rp30,000/kg liveweight) are far below those offered by traders (for the export market or Rp37,000). In addition, the farmers must pay for their own transport costs (Rp750,000 for a truck with five head, or Rp150,000 per head). This does not include the transaction costs of aggregating the cattle and the risk of injury or death in transport.

	Beef	Offal	Hide	Legs	Head	**Total**	**Rp/LW equivalent**
% yield	49%	26%	9%				
Price (Rp/kg)	52,000	12,000	14,000				
205kg LW							
yield (kgs)	99.6	52.4	18.9				
revenue	5,179,808	629,164	264,923	25,000	125,000	6,223,894	**30,360**
190kg LW							
yield (kgs)	92.2	48.5	17.5				
revenue	4,794,480	582,360	245,215	25,000	125,000	5,772,056	**30,419**

Figure 21. Receipts for cattle sales to RPH Pototano, Sumbawa Barat

Selling through this channel decreases returns by 70% in wet season to Rp56,048 per day equivalent, and explains why the abattoir is struggling to buy cattle for slaughter. The abattoir would have to increase its' carcass prices to Rp67,000 per kg to be price competitive with the traders.

Finance

Because some farmers in the village take out loans, this is tested. Compared to an opportunity cost of labour based on a savings rate (8%) in the representative household (Rp185,203 per labour day), a loan taken out under KKPE at a subsidised effective rate (6%) increases returns slightly to Rp195,265. Taking out a loan at a commercial rate (13%) leads to returns of Rp162,871.

Returns without FTL

For cattle fattening without tree forages:

- All parameters for the representative household in wet season were used (including prices of both feeder to fattened cattle of Rp37,000), with the following exceptions:
- The diet is based in improved grasses (70%), corn silage (30%)
- Weight gains reduced to 0.15kgs per day (a generous assumption)
- The household incurs no costs or revenues for leucaena establishment or cutting, no collection costs and the there are no shading / moisture effects on corn production
- Households spend an extra 0.5 of an hour collecting and chopping straw

In this case, “E. Net profits (excluding labour)” are low (Rp19,250) and “F. Net profits (including labour)” are negative (-19,201 per day). As can be seen in *Figure 18. Budget scenarios NyerotFigure 22*, “H. Returns to person days” are low at Rp25,032. This suggests that households have clear incentives to adopt leucaena-based fattening systems

BUDGET SUMMARY - over fattening period	Wet season rep	Dry season rep	Wet - to Sumbawa abattoir	Dry - to Sumbawa abatoir	Wet - KKPE loan	Wet - commercial loan	Straw / grass based diet
A. Main paramaters							
Cattle							
Number feeders in stock (head)	10	3	10	3	10	10	10
Days on feed (days)	148	105	148	105	148	148	148
Number fattened over year (head)	20	9	20	9	20	20	20
Weight entry to household (kg)	131	153	131	153	131	131	131
ADWG (kg / day)	0.5	0.35	0.5	0.35	0.5	0.5	0.15
Weight exit of household (kg)	205	190	205	190	205.0	205.0	153
Feed							
DM intake (kg/head/day)	4.2	4.3	4.2	4.3	4.2	4.2	2.8
Proportion FTL in diet	100%	60%	100%	60%	100%	100%	0%
Prices							
Cattle purchase price (Rp/kg LW)	37,000	37,000	37,000	37,000	37,000	37,000	37,000
Cattle sales price (Rp/kg LW)	37,000	37,000	30,360	30,419	37,000	37,000	37,000
Opportunity cost of labour (Rp/day)	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Capital cost	8%	8%	8%	8%	7%	13%	8%
B. Revenues	**76,083,613**	**21,269,548**	**62,471,613**	**17,523,314**	**76,083,613**	**76,083,613**	**56,706,745**
Cattle sales (Rp/fattening period)	75,850,000	21,062,250	62,238,000	17,316,016	75,850,000	75,850,000	56,684,000
Value of manure (Rp/fattening period)	33,613	7,298	33,613	7,298	33,613	33,613	22,745
Sale of timber	200,000	200,000	200,000	200,000	200,000	200,000	0
C. Costs (excl labour and capital costs)	**52,205,206**	**19,642,717**	**53,493,921**	**20,032,717**	**52,193,921**	**52,193,921**	**49,455,362**
Cattle purchase (Rp/fattening period)	48,470,000	16,983,000	48,470,000	16,983,000	48,470,000	48,470,000	48,470,000
Non-labour feed and water costs (Rp/fattening period)							
FTL and improved grasses purchased	0	0	0	0	0	0	0
Bran and other supplements	0	0	0	0	0	0	0
Fuel and water	0	0	0	0	0	0	0
Veterinary and additives	768,000	217,500	768,000	217,500	768,000	768,000	768,000
Cattle marketing costs							
Purchases	10,000	3,000	10,000	3,000	10,000	10,000	10,000
Sales	10,000	3,000	1,310,000	393,000	10,000	10,000	10,000
Depreciation of FTL, kandang, water, motorbike,	210,220	494,437	198,935	494,437	198,935	198,935	197,362
Land contract fee for FTL	0	0	0	0	0	0	0
Crop shading	2,736,986	1,941,781	2,736,986	1,941,781	2,736,986	2,736,986	0
H. Returns to person days							
Returns to person days (including capital costs)	**185,203**	**-10,608**	**43,636**	**-142,375**	**195,265**	**162,871**	**25,032**

Figure 22. Budget scenarios Jati Sari

5 References

BPS (2013) *Laporan Hasil Sensu Pertanian* 2013

BPS (2013a) Hasil Sensus Pertanian (ST2013) Provinsi Nusa Tenggara Timur, Tahun 2013.

BPS NTB (various years) *Nusa Tenggara Barat Dalam Angka*

BPS NTT (various years) *Nusa Tenggara Timur Dalam Angka*

Dahlanuddin., Hermansyah, and Happy Poerwoto (2008) Bali cattle production systems in the collective housing system on Lombok. *Jurnal Ilmu dan Teknologi Peternakan* Vol 2 (2): 502-510.

Dahlanuddin, Baiq T. Yuliana, Tanda Panjaitan, Michael Halliday, Elske van de Fliert and Max Shelton (2014) Survey of Bali bull fattening practices in central Lombok, eastern Indonesia, based in feeding of Sesbania grandiflora, *Animal Production Science*, 2014, 54, 1273-1277.

Deblitz, C., Kristedi, T; Hadi,P.U; Triastonneo, J; Puspadi, K and Nasrullah (2011) *Benchmarking the beef supply chain in eastern Indonesia*. Final Report SMAR/2007/202, The Australian Centre for International Agricultural Research, Canberra.

DGLAHS (various years) *Statistik Peternakan dan Kesehatan Hewan (Livestock and Animal Health Statistics)*, Direktorat Jenderal Peternakan dan Kesehatan Hewan, Jakarta.

Halliday, M., McSweeney, C., Shelton, M., Giles, H. and Pacha, Nahuel (2014) Summary of Australian Research, Presentation for annual meeting 2014 LPS/2008/054

Hermansyah and Mastur (2008) *Pemotonnegan ternak tidak tercatat, studi di Kota Mataram, Nusa Tenggara Barat*. In Prosiding Seminar Nasional Sapi Potonneg, 24 November 2008.

Fauzan, Muhammad (2015) Progress in adoption of bull fattening with FTL in existing locations and the keys to success, SUMBAWA, Sumbawa Besar. Presentation at project workshop LPS/2008/054, Carnarvon Gorge, December 8-9, 2015

Flewelling, J. 2013. Eastern Indonesia agribusiness development opportunities - analysis of maize value chains. A report prepared by Collins Higgins Consulting Group Pty Ltd for the Australian Centre for International Agricultural Research for ACIAR Project AGB-2012-007.

Kecamatan Fatuleu (2011) Data Peternak SE-kabupaten Kupang)

Ministry of Agriculture of The Republic of Indonesia and Central Statistics Agency of The Republic of Indonesia (2012). Release of 2011 PSPK Final Result

Mulik, M (2012) Pembangunan Pertanian Yang Selaras Wilayah Lahan Kering Iklim Kering di Indonesia: Potensi, tantangan, dan strategi pengembangan. Presentation for Pertemuan Alumni SMKPPN, Kupang, 27 Oktober 2012.

Nimmo-Bell and Company Ltd and Indonesian Center for Agriculture Socio-Economic and Policy Studies (May 2007) Value chain analysis for SADI agri sectors: The NTT Beef Industry. IFC SADI Agri Sectors.

Pakereng, Charles (2015) Progress in adoption of bull fattening with FTL in new (and existing) locations and the keys to success, Villages: Oebola Dalam, Naunu, Camplong I, Nunsaen, Ekateta, Uel, and Raknamo, West Timor, Kupang District. Presentation at project workshop LPS/2008/054, Carnarvon Gorge, December 8-9, 2015.

Quigley, S and Poppi, D (2009) Strategies to increase growth of weaned Bali calves, Final report for the project LPS/2004/023 for the Australian Centre for International Agricultural Research

Shelton, M (and team) (2015) *Improving smallholder cattle fattening systems based on forage tree legume diets in eastern Indonesia and northern Australia*, Final Report for ACIAR Project LPS/2008/054

Yuliana, Baiq T. (2015) Progress in adoption of bull fattening with FTL in existing locations and the keys to success, CENTRAL LOMBOK, Lombok. Presentation at project workshop LPS/2008/054, Carnarvon Gorge, December 8-9, 2015

Waldron, S., Dahlanuddin, Mayberry, D., Mulik., M., Quigley, S. and Poppi, D. (2013) *Eastern Indonesia agribusiness development opportunities - analysis of beef value chains*. A report prepared by Collins Higgins Consulting Group Pty Ltd for the Australian Centre for International Agricultural Research for ACIAR Project AGB-2012-005.

Waldron, S.A., Brown, C.G. and Longworth, J.W. (2010). A critique of high-value supply chains as a means of modernising agriculture in China: The case of the beef industry, *Food Policy* 35: 479-487.

Waldron, S.A. (2010). *Modernising Agrifood Chains in China: implications for rural development*. Cambridge Scholars Publishing, Newcastle upon Tyne

Appendix 1. Treatment of budget items

To aid use and understanding of the budget, this appendix provides a summary of the budget structure and treatment of budget items. Detailed explanatory notes for each item are included in the budget template.

Structure

- The budget consists of 2 parts and 5 worksheets:
    - **Input sheets**: "Main parameters", "Capital investments", "Ongoing costs" and "Revenues"
    - **Output sheets** (budget summaries): "Budget summary", "Budget scenarios"
- Within each worksheet, budget items are listed vertically, with the "Base scenario" appearing in Column H. To simplify use and modification of the budget, values and conversions are, where possible, explicitly listed in headings (vertically) rather than using more complex and difficult-to-trace formula. The budget is designed to be transparent and user-friendly for researchers and use in the field.
- After parameters of the base scenario are entered in Column H, other columns are used to adjust parameters, run scenarios and test effects. This allows for easy comparison between scenarios (rather than running scenarios multiple times)
- Inputs into the budget are converted (throughout the input sheets) and reported on over the fattening period.

"Main parameters" sheet

This sheet lists the main parameters that are used as precedents throughout the budget, and that are most likely to be adjusted to run scenarios.

Biophysical data derived from site monitoring data includes:

- **Feeder numbers** (in stock, and over the year)
- **Weight parameters** (LW bought in, days on feed, ADWG, LW sold out)
- **Ration**. Because of diet variability and measurement problems, LPS/2008/054 does not record rations weights. Instead, rations are determined as an estimate of the percentage of different feeds (FTL, grass, stover, supplements like rice bran). These are converted to weights by assuming DM intake as a percentage of body weight (e.g. 2.5%). However, these coefficient can be changed, and the weights are used as a physical check only, and not to calculate costs (which are done in the "Ongoing costs" sheet).

"Market" data entered here includes:

- **Cattle purchase and sales prices**, expressed on a per kg LW basis (empty).
- The **opportunity cost of labour**, expressed as the average daily wage for hired farm or off-farm work. Note that the budget does not disaggregate between gender and generation. Detailed enquiry and expert opinion suggested little differentiation in cattle-related work (although women tended to clean kandangs more) or labour rates for hired farm work in particular.

- **Capital costs**, of which there are 2 types – a savings rate, and an effective lending rate. These are used to calculate the opportunity costs of investment in cattle and equipment, that could otherwise be saved, or for the cost (effective interest rate) on any loan taken out.

"Capital investments" sheet

This sheet accounts for fixed investments in capital assets used for cattle fattening including tree forages, kandang, motorbike, water, biogas and other machinery.

- Establishment costs are:
- Disaggregated into equipment and labour costs
- Adjusted by the proportion of the asset used by feeder cattle (cow-calf feeding, other household activities).
- Multiplied by an interest rate to derive capital costs (or a proxy for repair costs)
- And divided by the lifespan of the investments to derive flat rate depreciation costs.
- Values are converted to derive costs over the fattening period.
- Users are asked to specify the number of cattle that the kandang, motorbike, water, biogas and other machinery was built or invested for (e.g. 3 head for 365 days per year). Entry of the actual numbers of head in stock (e.g. 2 head) or days on feed (e.g. 300 days) is used to establish capacity utilisation. When the infrastructure is under-utilised, overhead costs are still incurred at a higher per head cost, but decrease as capacity is reached. Users have to manually check that capacity is not exceeded.

- **FTL establishment** includes:
    - Any land contracting costs
    - As a physical check, the number of trees required to feed the specified number of cattle is calculated based on indexes from LPS/2008/054
    - Because the timber harvested from FTL is a revenue item (see "Revenues" sheet), and because aged trees will need to be periodically replaced, the costs of cutting and transport is inputted here.
    - Planting costs (seeds, nursery, transplanting, watering, labour)
- **Kandang construction** and depreciation are treated similarly**:**
    - Construction costs (timber, nails, concrete, labour) and lifespan are entered to derive capital and depreciation costs ,
- **Motorbikes** are a major capital investment of farmers and used widely for fattening (feed collection and other jobs like cattle buying and selling cattle), but also for many other household activities. Cattle fattening therefore attract capital and depreciation costs, but only minor proportion of total motorbike costs.
- **Biogas converters** are common in West Timor and Sumbawa, especially where there are concentrations of intensive cattle feeding and kandangs. These are usually distributed as part of government programs (so low equipment costs) but require significant household labour to

install. Installation means that manure fed into the biogas tanks can be valued as a revenue of cattle fattening along with fertiliser value (see "Revenues" sheet).

- Provision is made for other assets if required
- **Water facilities** (well, pipe, pump) investments are costed where relevant
- **Capital costs** on equipment are then summed from asset-specific calculations above based on a savings rates.
- **Depreciation costs** are also summed from asset-specific calculations above.
- Equipment and labour costs are disaggregated for use in budget reporting.

"Production costs" sheet

These are costs that are incurred frequently – on a daily basis or within the fattening cycle – of which there are several.

- **Feeder cattle** are the biggest cost of course the biggest cost item.
    - The cattle can be purchased off-farm at weights and prices specified in the "Main parameters" sheet. In this case there may be search, transport and brokerage costs. If a loan is taken out to purchase the cattle, the effective lending rate is specified, otherwise a savings rate is applied
    - Alternatively, the feeder cattle can be sourced from the cow-calf herd of the household. In this case, it is assumed that there are no purchase costs. However, the feeder could be sold and the money banked or re-invested so there is an opportunity value of the livestock and a capital cost (assumed to be a bank saving rate)
- **Cattle marketing costs** include
    - The cost per head of buying cattle (telephone, search / motorbike fuel, labour)
    - And selling cattle (same items)
    - Note that these are vary depending on the source of cattle (on-farm vs off-farm), distance and road condition, and purchase/sales terms with traders and slaughterhouses.

Feed costs

- **FTL collection** costs are calculated through the following methods
    - This section can be used to calculate the costs of leucaena, sesbania, glyracidia or a combination of these (treated together).
    - Based on data entered in "Main parameters" the budget calculates the amount of DM FTL required per head per day and over the fattening period.
    - Site monitoring data is entered on the average distance travelled to collect FTL, number of times per day, and hours required.
    - These values are not used to calculate budget results, but used as a physical check / reference to help estimation of the number of hours spent per day cutting FTL branches, bundling for transport, and transport back to the kandang.

  - It is assumed that there is no value attached to own-produced FTL. While a handful of farmers sell FTL in Oebola for example, this was confined to one area close to a cattle market, and not considered a viable or long-term farm activity.
  - However, it is quite common for farmers to buy rights to access to the trees or forage of other households for a specified number of trees, area, cuts, time and cost. This option can be selected if relevant.
  - Motorbike fuel costs are specified for FTL collection.
  - With the exception of motorbike fuel costs, all ongoing costs associated with FTL collection and feeding are labour (collection) costs.

- **Improved grasses** (elephant grass, king grass) are treated in the same way
- **Native grasses** are assumed not to be purchased, but costs are associated with collection and fuel.
- S**tover and straw** are treated in the same way, with additional labour for chopping if required.
- **Rice bran** is sometimes fed as a supplement feed and if so, users are asked to specify the number of days and weight fed. A ready market and value has been established for rice bran, so a market value is value is used to cost the feed
- Provision is made for other supplements if required (e.g. peanut of soybean bran)
- **Water costs** are calculated based fuel for a water pump (if relevant) and the labour required to carry and pour water

Veterinary and additives costs

- **Vaccination** costs can apply, especially for cattle especially if fattened for the inter-island export market (SE, anthrax). Applied on a dose per head basis.
- Provision is made for other treatments if required. In some areas (around paddies and in wet season), project staff recommend treatment for liver fluke.
- Some households request assistance from Dinas vets or animal paramedics for a range of vet problems (eyes, diseases, ill-thrift). They charge for the cost of the visit and vet products.

Fattening households commonly use additives to the diet on the (questioned) grounds that it aids weight gain. This includes:

- **Vitamins B** supplements are valued on a dose per animal over the fattening period and the number of cattle produced over the year. Costs can be significant
- **Antibiotics**
- **Salt** is fed at a specified rate (grams) by a local market price over the feeding period. Costs are negligible.
- Provision is made for other supplements if required

Kandang labour

- Kandang labour is specified by the number of hours worked per day in the kandang and the proportion of the kandang labour used for feeders (as opposed to other cattle) and the number of feeders
- Work includes tending cattle, cleaning, drainage and pen repair. The time-consuming jobs of separating smaller branches and disposing of branches not eaten are attributed to this kandang labour, rather than feed collection.

Crop shading

- The growing of FTL can lead to shading of crops and reduce yields and returns. This calculated in the budget by a percentage yield loss from FTL (set at 5% for sesbania planted on bunds, 10% for leucaena planted on the perimeter of corn fields, and 30% for leucaena in alley cropping with corn.
- No valuation is made for soil moisture extraction but this is unlikely to be high and potentially offset by soil improvement effects.

"Revenues" sheet

Revenues from cattle fattening include the sale of finished cattle, manure and the sale of FTL timber.

Finished cattle revenues are calculated through inputs in the "Main parameters" sheet based on weight and (per kg) price, and number sold over the year.

Manure

- **Output of manure** is estimated based on a proportion of DM feed intake. This provides a physical check used in subsequent calculations. Users can specify the proportions for various uses (none, sold, fertiliser, biogas).
- **Sales.** There are examples of groups selling manure, which can be directly valued.
- **Value as fertiliser**. The manure can be used to substitute for urea or complete (NPK) fertiliser. The amounts substituted are estimated and a market price applied to derive the value of the manure.
- **Value as biogas feedstock**. The manure from the kandang is used to produce gas for cooking and light. In NTT (Oebola) this substituted for firewood that had to be collected every day on the way back from the fields. The time taken and the opportunity costs of labour establishes the value of the manure. Alternatively, the biogas can substitute for LPG or kerosene, which is used at a specified rate and price.

FTL timber

- The budget provides a physical check of timber supply (trees and branches).
- Revenues from FTL can be specified including the trunks of sesbania for housing etc. (raw or soaked and sold at a higher price), and from the mature branches of leucaena trees (for firewood etc.)

"Budget summary – fattening period" sheet

Budget results are reported using standard methods

A. Main parameters are first reported in summarised form to define the scenario under review. This includes

- Cattle (number, entry weight, days on feed, ADWG, exit weight)
- Feed (DM intake and % FTL in diet)
- Prices (per kg, entry and exit)
- Opportunity cost of labour

B. Revenues include

- Sale of finished cattle – that account for virtually all revenues
- Value of manure (small proportion of revenues)
- Sale of FTL timber (small proportion of revenues)

C. Costs (excluding labour)

- Cost of feeder cattle – that account for >90% of all non-labour costs.
- Other items listed below make up 0.5-2% including
    - Direct feed costs (motorbike fuel, supplements)
    - Veterinary and additives
    - Cattle marketing costs
    - Depreciation of capital equipment, which are highest, because of motorbike and kandang costs
    - Land contracts
- While these proportions are small, they are still significant. These are cash outlays from the household, margins on cattle fattening can be fine, and the costs can be higher in some scenarios.

D. Gross profit (returns to capital, labour & management)

- D. is derived by subtracting C. Costs (excl labour) from B. Revenues
- This is converted to a daily return over the fattening period
- Under most scenarios this can be expected to be positive, especially given the low (non-labour) feed costs.

E. Net profit (returns to labour & management)

- E. is derived by subtracting capital costs from D. Gross profit
- This is converted to a daily return over the fattening period
- The capital costs of feeders account for the large majority of all capital costs, which are a significant item
- Capital costs are usually lower for the equipment (i.e. not labour) costs of infrastructure (FTL, kandang, motorbike, water and biogas assets)

F. Net profit (returns to management)

- F. is derived by subtracting labour costs from E. Net profit
- Labour costs are calculated by multiplying days worked on cattle fattening (from activity-specific calculations) multiplied by a hired farm or off-farm wage. Because of the substantial time investment in fattening and because wages are based on market rates, the labour cost is high, and can amount to many millions of Rupiah.
- Under most scenarios, this makes returns to management negative.
- The vast majority (>90%) of labour costs are in feed collection and kandang labour.
- While the upfront labour required to construct capital assets (FTL, kandang, biogas) can be significant, they are allocated to a large number of cattle over the lifespan of the assets, so appear as a negligible item in the budget.
- Cattle marketing costs are around 4-6% of the labour budget.

G. Labour days per head over fattening period

It is commonly claimed that rural households in Eastern Indonesia do not value their own labour. Hired farm or off-farm labour used to establish a market-based opportunity cost of labour can be inconsistent, seasonal or unavailable to many farmers. Calculation of "Returns to labour" may therefore be a better reflection of household incentives. To do this

- Labour days are calculated by the budget based on previous parameters (with the same proportional breakdown as established in F. "Returns to management" above).
- This is also used to calculate the number of hours per day that the household spends on cattle fattening

H. Returns to person days

- To enable comparison with the returns to alternative activities, daily returns are adjusted by the number of hours that spent on cattle fattening to derive "returns to person days" (8 hours)
- Thus, G. "Labour days" is divided by both:
    - D. "Gross profit (returns to capital, labour & management)" to derive H. "Person days returns to capital, labour and management", and
    - E. "Net profit - Returns to management and capital" leads to H. "Person days returns to labour and management"
- Most scenarios lead to a positive return to labour, meaning that households are earning income from the activity (e.g. Rp35,000 per day in cash income, well above the poverty line).
- In most cases, this is lower than the average daily wage (e.g. Rp50,000), hence the negative value in F. "Returns to management".
- However, this daily return to fattening is generally more consistent than off-farm work, and farmers can be attracted to the value of own-enterprise and the "savings" function of cattle for broader household livelihood strategies.

I. Profit-sharing - keeper

In project sites, cattle owners and keepers often enter into profit sharing agreements, where a cattle owner will provide the capital costs of the feeders, and the keeper fattens the animal over the fattening period, providing labour and feed costs. Other costs and profits can be shared in various ways. The profit share (e.g. 60%) is multiplied by "D. Gross profit" (returns to capital, labour and management) (not "E. Net profit" on the assumption that the keeper does not incur capital costs as the owner provides bull) to derives "Returns over fattening period". This is divided by the labour input to derive "Daily returns over fattening period" and "Returns to person days".

It is important to note that there are large numbers of permutations on the arrangement – e.g. the owner pays vet costs and transport costs, or contributes to infrastructure costs. These have a significant effect on the relative returns, and are able to be calculated using the spreadsheet.

J. Profit sharing – owner

Profits for the owner ("Returns over fattening period") are derived by multiplying by the profit sharing agreement (e.g. 40%) by E. "Returns to labour and management" (not D. "Gross profit" or F. Net Profit (Returns to Management" because it is assumed that the owner doesn't input any labour). This is simply divided by the cost of the feeder cattle (provided by the owner) to derive "Returns to capital". Note that includes the capital costs of the cattle, so is the equivalent of net yield.

Appendix 2. Spreadsheets

For an understanding of the structure and details of the household budgets, scans of budget components are pasted below. The full budget is available on request.

			Wet season - representative housheold	Dry season - representative household
Main parameters				
Biophysical				
	Cattle numbers			
		Cattle in stock (head)	4	4
		Days of year cattle in stock	330	330
		Cattle sold over year (head)	8	8
	Weight parameters			
		LW bought in (kg)	189	189
		Days on feed (days)	170	170
		ADWG (kg / day)	0.4	0.2
		LW sold out (kg)	257	223
		LW added over fattening period (kg)	68	34
		Average weight over period (kg/head/day)	223	206
	Ration (%)			
		DM feed intake as % of av body weight (%/day)	2.5%	2.0%
		FTL (leucaena and gliricidia)	80%	40%
		Improved grasses	0%	0%
		Native grass and local tree leaves	18%	60%
		Straw / stover / silage	3%	0%
		Rice bran	0%	0%
		Other supplement	0%	0%
Market				
	Cattle prices			
		Cattle purchase price (Rp/kg LW)	29,000	29,000
		Cattle sales price (Rp/kg LW)	29,000	29,000
		Price difference	-	-
	Opportunity cost of labour (Rp/day)		45,000	45,000
	Capital costs			
		Interest rate for loans	6%	6%
		Interest rate on savings (opportunity cost own capit	8%	8%

	Wet season - representative housheold	Dry season - representative household
Capital investment / fixed investment (over fattening period)		
Design capacity for kandang, water, motorbike and biogas facilities		
Number of cattle in stock	4	4
Design for number of cattle in stock (head)	5	5
Days per year cattle in stock	330	330
Capacity utilisation	72%	72%
TFL establishment		
Contracted land costs		
Any land contracted (1=yes, 0=no)	0	0
Area of land contracted (ha)	1	1
Cost of contracting (Rp/year)	200,000	200,000
Cost of contracting (Rp/fattening period)	0	0
Number of trees required per animal	300	300
Number of trees required for herd	1200	1200
Cutting interval (days)	120	120
Cost of cutting down and selling existing trees		
Transport	100,000	100,000
Labour for cutting all trees (day	3	3
Planting costs		
Fencing of FTL land		
Is there an existing fence? (0=\	0	0
equipment (posts, wire)	300,000	300,000
labour (days)	10	10
Seeds		
Trees planted	1,200	1,200
Seeding success rate	67%	67%
Seeds required	1,791	1,791
Cost per seed (Rp)	5	5
Total cost	8,955	8,955
Nursery		
Poly bags	50,000	50,000
Bedding	0	0
Shade cloth	100,000	100,000
Total equipment	150,000	150,000
labour (days)	5	5
Transplanting		
Transport	50,000	50,000
labour (days)	5	5
Total costs		
equipment (Rp)	308,955	308,955
labour (Rp)	585,000	585,000
% FTL used for fattening	80%	80%
Capital cost over fattening period (Rp)		
equipment (Rp)	9,209	9,209
Lifespan (years)	40	40
Depreciation allocated to fattening period (Rp)		
equipment	2,878	2,878
labour	5,449	5,449

	Kandangs												
		Construction costs (Rp)											
			Nails							100,000		100,000	
			Wire							25,000		25,000	
			Timber							0		0	
			Cement							500,000		500,000	
			Sand							170,000		170,000	
			Gravel							170,000		170,000	
			Reinforcement							150,000		150,000	
			Troughs							20,000		20,000	
			Roof							0		0	
			Other							0		0	
			Labour							450,000		450,000	
		Total costs											
			equipment							1,135,000		1,135,000	
			labour							450,000		450,000	
		% used for fattening								80%		80%	
		Capital cost								8%		8%	
			equipment (Rp)							72,640		72,640	
		Lifespan (years)								20		20	
		Depreciation allocated to fattening period (Rp)											
			equipment							14,617		14,617	
			labour							5,795		5,795	
	Motorbike												
		Cost								16,000,000		16,000,000	
		% used for feed collection and cattle marketing								20%		20%	
		Equipment cost allocated to fattening (Rp)								3,200,000		3,200,000	
		Capital cost (Rp)								51,200		51,200	
		Lifespan (years)								15		15	
		Depreciation allocated to fattening period (Rp)								137,374		137,374	
	Other transport / machinery												
		Does the group have a straw chopper? (1=yes, 0=no								0		0	
		Cost								5,000,000		5,000,000	
		% used for feed collection and cattle marketing								100%		100%	
		% allocated to individual household (in group)								10%		10%	
		Equipment cost allocated to fattening (Rp)								0		0	
		Capital cost								0		0	
		Lifespan (years)								7		7	
		Depreciation allocated to fattening period (Rp)								-		-	
	Water												
		Installation											
		Was water infrastrcuture installed? (1=yes, 0=no)								1		1	
			Well							1,500,000		1,500,000	
			Pump							0		0	
			Pipes							0		0	
			Meals for installers							100,000		100,000	
			Person days labour							0		0	
		Total costs											
			equipment							1,600,000		1,600,000	
			labour							-		-	
		% of water used for for fattening								30%		30%	
		Capital cost											
			equipment							38,400		38,400	
		Lifespan (years)								15		15	
		Depreciation cost of facility over fattening period (Rp)											
			equipment							20,606.06		20,606.06	
			labour							-		-	
	Biogas												
		Does the hh have biogas facilities? (1=yes, 0=no)								1		1	
		Installation											
			All facilitities (tank, pipes, converter)							0		0	
			Meals for installers							200,000		200,000	
			Person days labour							10		10	
		Total costs											
			equipment							200,000		200,000	
			labour							450,000		450,000	
		% of manure that comes from fattening								80%		80%	
		Capital cost								8%		8%	
			equipment							12,800		12,800	
		Lifespan (years)								10		10	
		Depreciation cost of facility over fattening period (Rp)											
			equipment							10,303.03		10,303.03	
			labour							23,181.82		23,181.82	
	Capital costs for capital investment over fattening period												
		Equipment								184,249		184,249	
	Depreciation costs for capital investment over fattening period												
		Equipment								185,778		185,778	
		Labour								34,427		34,427	
		Total								220,205		220,205	

	Wet season - representative household	Dry season - representative household
Production Costs		
Cattle purchase cost		
Liveweight (kg)	189	189
Price (Rp/kg)	29,000	29,000
Cost per head (Rp)	5,481,000	5,481,000
Cost per fattening period (Rp)	21,924,000	21,924,000
Capital cost on cattle	1,753,920	1,315,440
Cattle marketing costs		
Cattle purchase cost (per head)		
Bought off-farm (=1), bought farm-gate (=0)	1	1
Telephone costs (Rp/head)	1,000	1,000
Motorbike fuel / search costs (Rp/head)	5,000	5,000
Trucking costs (Rp/head)	50,000	50,000
Trader / broker fees (Rp/head)	0	0
Total cash cost (Rp/head)	56,000	56,000
Total cash cost over fattening period	224,000	224,000
Labour required to buy (days / head)	1.0	1.0
Total labour cost over fattening period	180,000	180,000
Cattle sales cost (per head)		
Bought off-farm (=1), bought farm-gate (=0)	0	0
Telephone costs (Rp/head)	1,000	1,000
Motorbike fuel / to meet with buyer (Rp/hea	5,000	5,000
Trucking costs (Rp/head)	50,000	50,000
Trader / broker fees (Rp/head)	0	0
Total cash cost (Rp/head)	1,000	1,000
Total cash cost over fattening period	4,000	4,000
Labour required to sell (days / head)	1	1
Total labour cost over fattening period	180,000	180,000
Feed costs		
Parameters		
DM feed intake as % of av body weight (%/da	2.5%	2.0%
Weight total ration (kg DM/head/day)	5.6	4.1
Weight feed (kg DM/all cattle fed over fatten	3,791	2,802
FTL		
Requirements		
% diet	80%	40%
Weight per head in diet (kg DM / day)	4.5	1.6
Weight (kg DM / herd over fattening period)	3,033	1,121
FTL purchased on tree		
Is FTL purchased on tree from others (yes=1,	0	0
Number of trees for cutting (Rp/cut)	100	100
Weight per tree (kg DM / cut)	0.42	0.42
Total weight all trees (kg DM / cut)	42.0	42.0
Cost (Rp / cut)	200,000	200,000
Number of cuts per fattening period purchas	1	1
Cash cost	-	-
FTL from own trees		
Distance travelled to cut (km)	1.0	1.0
Times collected per day	2	2
Time spent to collect, cut, feed (hrs/day)	1.5	1.5
Labour cost (Rp/day)	8,438	8,438
Labour cost (Rp/fattening period)	1,434,375	1,434,375
Motorbike fuel for collection for all feeders (	700	700
Fuel cost (Rp/fattening period)	119,000	119,000
Improved grass		
Requirements		
% diet	0%	0%
Weight per head in diet (kg DM / day)	-	-
Weight (kg DM / day)	-	-
Improved grass purchased in field		
Are improved grasses purchased in field (yes	0	0
Area of land to be cut (sq m)	40	40
Yield (kg DM / sq m)	5.00	5.00
Total weight improved grass (kg DM / cut)	200	200
Cost (Rp / cut)	50,000	50,000
Number of cuts per fattening period purchas	2	2
Cash cost	-	-
From own plot		
Time required to transplant (days per year)	3	3
Distance travelled to cut (km)	1	1
Times collected per day	1	1
Time spent to collect, cut, feed (hrs)	1	1
Labour cost (Rp/day)	-	-
Labour cost (Rp/fattening period)	-	-
Motorbike fuel for collection (per cut)	100	100
Fuel cost (Rp/fattening period)	-	-
Native grasses and local tree leaves		
Requirements		
% diet	18%	60%
Weight per head in diet (kg DM / day)	1.0	2.5
Weight (kg DM / day)	28,293.1	71,688.0
Collected		
Distance travelled to cut (km)	1	1
Times collected per day	1	2
Time spent to collect, cut, feed (hrs)	1.0	2.0
Labour cost (Rp/day)	5,625	11,250
Labour cost (Rp/fattening period)	956,250	1,912,500
Motorbike fuel for FTL collection for all feede	350	700
Fuel cost (Rp/fattening period)	59,500	119,000

		Straw / stover / silage				
			Requirements			
			% diet	5%		0%
			Weight per head in diet (kg DM / day)	0.3		-
			Weight (kg DM / day)	0.3		-
			Collection			
			Distance travelled to cut (km)	1		1
			Times collected per day	1		1
			Time spent to collect, cut, feed (hrs)	0.1		0.0
			Labour cost (Rp/day)	365		-
			Labour cost (Rp/fattening period)	18,625		-
			Motorbike fuel for FTL collection for all feeds	150		-
			Fuel cost (Rp/fattening period)	28,500		-
			Chopping labour			
			Time spent to chop and feed (hrs/day)	0.0		0.0
			Labour cost (Rp/day)	-		-
			Labour cost (Rp/fattening period)	-		-
		Rice bran				
			Requirements			
			% diet	-		-
			Number of days fed (days)	50		50
			Weight per head in diet (kg DM / day)	0.5		0.5
			Cost			
			Price (Rp/kg DM)	2,200		2,200
			Cost (Rp/head)	-		-
			Cost (Rp/fattening period)	-		-
		Other supplement				
			Requirements			
			% diet	-		-
			Number of days fed (days)	0		0
			Weight per head in diet (kg DM / day)	0.5		0.5
			Cost			
			Price (Rp/kg DM)	2,000		2,000
			Cost (Rp/head)	-		-
			Cost (Rp/fattening period)	-		-
		Water costs				
			Fuel / pipe / water access costs per year	240,000		240,000
			% used for fattening	50%		50%
			Cost (Rp/fattening period)	28,384		28,384
			Time spent watering (hrs)	0.5		0.5
			Labour cost (Rp/day)	2,613		2,613
			Labour cost (Rp/fattening period)	11,250		11,250
		Total (Rp / head over fattening period)				
			Labour	1,497,500		1,558,125
			FTL and improved grass "purchased"	-		-
			Supplements	-		-
			Fuel and water	257,384		270,384
	Veterinary and additives costs					
		Vaccination				
			Cost per treatment	12,000		12,000
			Times done over fattening period	1		1
			Cost (Rp/fattening period)	48,000		48,000
		Liver fluke				
			Cost per treatment	40,000		40,000
			Times done over fattening period	-		-
			Cost (Rp/fattening period)	-		-
		Other medical drinks				
			Cost per treatment	12,000		12,000
			Times done over fattening period	1		1
			Cost (Rp/fattening period)	48,000		48,000
		Vitamin supplement				
			Cost	50,000		50,000
			Times done over fattening period	1		1
			Cost (Rp/fattening period)	200,000		200,000
		Antibiotics				
			Cost	15,000		15,000
			Times done over fattening period	0		0
			Cost (Rp/fattening period)	-		-
		Salt				
			Amount (g / day / head)	50		50
			Price (Rp/kg)	2,000		2,000
			Cash cost (head/day)	100		100
			Cost (Rp/fattening period)	40,000		40,000
		Total (Rp/fattening period)		364,000		364,000
	Labour for kandang cleaning and cattle management in kandang					
		Labour for herd (hrs/day)		1.0		1.0
		% fattening		100%		100%
		Labour cost (Rp/day)		5,625		5,625
		Labour cost (Rp/fattening period)		225,000		225,000
	Crop shading					
		Rice				
			Crop area (ha)	0.0		0.0
			No. of crops per year	2		2
			Grain yield without FTL (kg/ha)	4,000		4,000
			Yield decrease from shading (%)	0%		0%
			Yield losses (kg)	-		-
			Grain price (Rp/kg)	5,000		5,000
			Value of losses (Rp)	-		-
		Corn				
			Crop area (ha)	0.5		0.5
			No. of crops per year	1		1
			Grain yield without FTL (kg/ha)	2,400		2,400
			Yield decrease from shading (%)	20%		20%
			Yield losses (kg)	240		240
			Price (Rp/kg)	5,000		5,000
			Value of losses (Rp)	120,000		120,000
		Total (Rp/fattening period)		120,000		120,000

							Wet season - representative household		Dry season - representative household	
Revenues										
	Cattle sales (per head)									
		Weight sold out					257		223	
		Sales price (Rp/kg LW)					29,000		29,000	
		Total (Rp/head)					7,453,000		6,467,000	
		Total (Rp/fattening period)					29,812,000		25,868,000	
	Manure									
		Manure produced over fattening period								
			% of DM intake				35%		35%	
			Production over fattening period (kg)				1,327		981	
		Manure use								
			% not used				50%		50%	
			% sold				10%		10%	
			% fertiliser				20%		20%	
			% biogas				20%		20%	
		Manure sales								
			Amount sold (kg)				133		98	
			Price (kg)				250		250	
			Revenue (Rp)				33,171		24,514	
		Value as fertiliser								
			Substitution of urea fertiliser							
				% urea in manure (conversion)			0.7%		0.7%	
				Amount subsituted (kg / fatten			2		1	
				Price (Rp/kg)			2,000		2,000	
				Value (Rp)			3,715		2,746	
			Substitution of NPK fertiliser							
				% NPK in manure (conversion)			1.5%		1.5%	
				Amount subsituted (kg / fatten			4		3	
				Price (Rp/kg)			2,500		2,500	
				Value (Rp)			9,951		7,354	
			Total opportunity value as fertiliser (Rp/f				13,667		10,100	
		Value of biogas								
			Displacement labour for firewood collection							
				Labour firewood collection (hrs			1		1	
				Value of labour (Rp per day)			5,625		5,625	
				Total value (Rp/fattening perio			956,250		956,250	
			Substitution of gas / kerosene							
				Hours / day cooking and light			1		1	
				Cost per hour (Rp)			3,000		3,000	
				Value of gas / kerosene (Rp/da			3,000		3,000	
				Total value (Rp/fattening perio			510,000		510,000	
				Maintainence and cleaning bio			1		1	
				Labour cost over fattening peri			255,000		255,000	
		Total value (Rp/fattening period)								
			Cash or substituted value (fertiliser and g				556,838		544,614	
			Labour value				701,250		701,250	
			Total				1,258,088		1,245,864	
	FTL timber									
		Trunks								
		Price (Rp / tree)					0		0	
		Number of trees					1,200		1,200	
		Value of trunks (Rp)					-		-	
		Value over fattening period (Rp)					-		-	
		Branches (leucaena)								
		Branches per tree per cut					2		2	
		Branches cut over fattening period					3,400		3,400	
		Value for sale or firewood					100,000		100,000	
		Total value trunk and branches					100,000		100,000	

BUDGET SUMMARY - over fattening period	Wet season - representative housheold	Dry season - representative household
A. Main paramaters		
Cattle		
Number feeders in stock (head)	4	4
Days on feed (days)	170	170
Number fattened over year (head)	8	8
Weight entry to household (kg)	189	189
ADWG (kg / day)	0.4	0.2
Weight exit of household (kg)	257	223
Feed		
DM intake (kg/head/day)	6	4
Proportion FTL in diet	80%	40%
Prices		
Cattle purchase price (Rp/kg LW)	29,000	29,000
Cattle sales price (Rp/kg LW)	29,000	29,000
Opportunity cost of labour (Rp/day)	45,000	45,000
B. Revenues	**30,468,838**	**26,512,614**
Cattle sales (Rp/fatteneing period)	29,812,000	25,868,000
Value of manure (Rp/fattening period)	556,838	544,614
Sale of timber	100,000	100,000
C. Costs (excl labour and capital costs)	**23,274,655**	**23,308,655**
Cattle purchase (Rp/fattening period)	21,924,000	21,924,000
Non-labour feed and water costs (Rp/fattening period)		
FTL and improved grasses purchased	0	0
Bran and other supplements	0	0
Fuel and water	237,534	271,534
Veterinary and additives	364,000	364,000
Cattle marketing costs		
Purchases	224,000	224,000
Sales	4,000	4,000
Depreciation of FTL, kandang, water, motorbike, biogas invest	185,778	185,778
Land contract fee for FTL	0	0
Crop shading	335,342	335,342
D. Gross profit (returns to capital, labour & management)	**7,194,183**	**3,203,959**
Per day over fattening period	**42,319**	**18,847**
Less capital costs, of which	1,938,169	1,499,689
Feeder cattle	1,753,920	1,315,440
Capital investments	184,249	184,249
E. Net profit (returns to labour & management)	**5,256,013**	**1,704,269**
Per day over fattening period	**30,918**	**10,025**
Less cost of family labour, of which	3,848,177	4,708,802
Capital investments	34,427	34,427
Cattle purchase and sales	360,000	360,000
Feed collection and water	2,497,500	3,358,125
Kandang work	956,250	956,250
F. Net profit (returns to management)	**1,407,837**	**-3,004,532**
Per day over fattening period	**8,281**	**-17,674**
G. Labour days over fattening period		
Family labour	**86**	**105**
Of which: Capital investments	0.8	0.8
Cattle purchase and sales	8	8
Feeding costs	56	75
Kandang work	21	21
Hours per day on cattle fattening	**4.0**	**4.9**
H. Returns to person days		
Returns to person days (excluding capital costs)	**84,128**	**30,619**
Returns to person days (including capital costs)	**61,463**	**16,287**
I. Profit-sharing - keeper		
60% keeper		
Returns over fattening period	4,316,510	1,922,375
Daily returns over fattening period	25,391	11,308
Returns to person days	50,477	18,371
J. Profit sharing - owner		
40% owner		
Returns over fattening period	2,102,405	681,708
Returns to capital	**9.6%**	**3.1%**