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Acronyms and commonly used terms

005 project	Refers to a precursor ACIAR project LPS-2004-005, Improving smallholder crop-livestock systems in eastern Indonesia
061 project	Refers to the sister project in South Sulawesi, SMAR-2006-096
096 project	Refers to the current project SMAR-2006-096
ANTARA	Australia-Nusa Tenggara Assistance for Regional Autonomy
Bappeda	Badan Perencana Pembangunan Daerah (regional body for planning and development)
BPP	Balai Penyuluh Pertanian (rural agricultural extension centre) Staffed by PPLs; generally under direction of relevant Dinas or Bupati
BPTP	Balai Pengkajian Teknologi Pertanian (Assessment Institute for Agricultural Technology)
BSS	Bumi Sejuta Sapi (Land of a Million Cattle); a provincial initiative
Bupati	Governor of the Regency or Kabupaten (equivalent of Regent)
CSIRO	Refers to CSIRO Sustainable Ecosystems (CSE is also used)
Dinas	Generally refers to Dinas Peternakan (Department of Livestock Services)
FG	Farmer group
FMA	Farmer Managed Extension Activities, coordinated by World Bank
IAT	Integrated Analysis Tool, a modelling tool for exploring scenarios
JICA	Japan International Cooperation Agency
Kandang	Communal system for housing and feeding livestock
Kepala	Head of relevant institute or group
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
OGT	On Ground Team (responsible for implementation & extension)
Penyuluhan	Used here as shorthand for Extension Office
PMT	Project Management Team (responsible for operations & coordination)
PPL	Penyuluh Pertanian Lapangan (field agricultural extension officers); many work closely with OGTs in relevant villages
PST	Project Specialist Team (responsible for technical expertise & training)
Satellite	Farmer living near a project kandang but not a member of the kandang group
SMD	Sarjana Membangun Desa (Graduates Working with Villages), a local government scheme providing funds to animal science graduates for work on a village-nominated development activity
SNA	Social Network Analysis
UNRAM	University of Mataram, Lombok

1 Acknowledgments

Foremost, we wish to acknowledge the smallholder farmers of Central Lombok and to thank them for generosity with their knowledge and expertise and for their faith in the project team.

A highlight for the Specialist Teams in Australia and Indonesia has been working alongside the On-Ground Team – Agus, Dewi, Fandi, Hayyi, Mar, Muji, Novi, Syahrul, Tina, Totok, Rama and Yadi. Their enthusiasm, enquiring minds and unfailing good humour have made SMAR-2006-096 an incredibly rewarding project.

Lukita Cesaria Ibundani and Lia Hadiawati kept the project running smoothly in Indonesia; Rebecca Wright and Veronica Hannan helped hold things together in Australia. Particular thanks to Catherine Hanley, Peter Horne and Mirah Nuryati from ACIAR for their support, advice and guidance.

The Program Advisory Committee was an important mechanism for keeping the project relevant to regional initiatives and targets. We thank each member for their time, support and willingness to contribute to many discussions over the course of the project.

Our students Imran and Mastur combined academic endeavours with strong team work and we hope they will be rewarded for their efforts by their respective universities.

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Finally, thanks to Dennis Poppi and the AS2-2000-103 research team and Shaun Lisson and the LPS-2004-005 research team for providing a solid and successful springboard for this project.

2 Executive summary

Bali cattle are an important contributor to the Indonesian beef industry and the majority of production comes from smallholder farmers in eastern Indonesia who own 2-4 cattle per household. Improving Bali cattle productivity on these smallholdings is vital not only to the Government's beef self sufficiency targets, but also to improving the economic development of farmers living in its poorest regions.

This project builds on the success of previous ACIAR projects that have identified productivity constraints in Nusa Tenggara Barat (NTB) and developed and successfully tested simple, low risk solutions in both collective and distributed systems. These practices – controlled mating with quality bulls, early weaning, preferential feeding and making better use of existing and introduced forage resources - along with improved kandang infrastructure and hygiene formed the foundation of the project.

Productivity gains from uptake of project practices included a calving rate of around 90%, with calf survival of around 95% and a calving interval of just over 12 months, which is very close to the project's stated aim of 'one cow, one calf, one year'. While herd size across the 36 project kandangs has remained relatively stable, births and sales have increased. Farmers are able to sell animals at a younger age because the weight gain between birth and weaning has increased. In this way, farmers - with limited space in existing kandangs to house new animals and little additional land to grow forages to feed them - are able to increase reproductive potential and convert this to greater throughput and increased sales without overt strain on other resources.

Although scaling out information from kandang groups was not a priority for the project, natural expansion of project ideas has occurred. Key institutions or activities for the spread of information were the mosque, family networks, use of the project bull and through collective activities such as forage collection.

Over four hundred satellite farmers (farmers in close proximity to the project kandang groups, but not members of them) took up some of the technology package, and bull services (and hence controlled mating) were the entry point. Satellite farmers generally received less information and were less certain of the value of project practices and how to implement them. While bringing cows for mating provided a good opportunity for discussion, limited information was shared and subsequent adoption was minimal.

To achieve widespread geographical benefit and impact, replication across an increased number of kandangs seems more viable (or faster) than farmer to farmer interaction over longer distances. Suggested areas of focus include uptake of project principles by local livestock agencies, support for key community players in information transfer, particularly kandang group members and bull keepers, and support for improvements in policy.

According to farmers, engagement with the project increased skills and knowledge of improved livestock management practices, and also the social capital of the groups, through increased cohesion, communication and cooperation.

The On Ground Team (OGT) is a group of well trained, and now experienced, field extension workers. A suite of relevant technical skills was developed throughout the project, as well as advanced abilities in problem solving and community engagement.

One of the greatest achievements by the project team has been its strong influence on relevant regional institutions. Strategic engagement with District and Provincial Dinas and extension staff and Bappeda staff, along with ongoing support from the Governor's Office and the Bupati of Central Lombok, has resulted in important policy linkages.

The project resulted in significant capacity and community impacts, with key economic (particularly increased sales) and social (particularly improved motivation and means to work collectively for mutual benefit) impacts felt by over 1100 households.

Recommendations for future work include: a detailed assessment to track livelihoods and other impacts after project close; an investigation of calf mortality in the project kandang; further study on when and why cows are being sold; expansion of the project approach to other areas and other farming systems of NTB; and the future use of an OGT model for projects requiring regular and effective community engagement.

3 Background

In Indonesia, the demand for beef far exceeds the capacity of the domestic beef production system. As a result, the country imports 28% of its national beef consumption (Departemen Pertanian Republik Indonesia 2007).

The national economy is changing rapidly, and increased affluence is fuelling a greater demand for higher quality and quantity of beef products. This change is driving regional and national policy to aim for self sufficiency in beef production.

Bali cattle are the most important contributor to the Indonesian beef industry and their production comes predominantly from smallholder farmers in eastern Indonesia who own 2-4 cattle per household.

Improving Bali cattle productivity on these smallholdings is essential not only to the Government's beef self sufficiency targets, but also to improving the economic development of farmers living in its poorest regions.

Smallholder farms and farmers in Lombok

Nusa Tenggara Barat is considered one of the least affluent Indonesian provinces, with 25% of its 1.1 million households living below the poverty line in 2006 (Badan Pusat Statistik 2007) and 55% of the population living on subsistence agriculture in 2004 (Patrick 2004).

The agricultural sector accounts for just under half NTB's workforce. Patrick (2004) suggests that the sector is under mounting pressure to become more productive due to increasing landlessness (over 35% of farmers collaborating in the project were landless), a rising population growth rate and relatively low education levels.

On-farm labour (eg land preparation, crop management, harvesting and marketing, livestock tending) is often supplemented by off-farm activities that may be agricultural (eg assistance on other farms) or non-agricultural (eg transport, small retail business, government position).

However, in less developed areas of NTB, market access is a constraint for smallholder farmers and the opportunities for non-agricultural work are limited as the demand for labour from other sectors is low.

Many provincial and national programs aimed at increasing farmers' income have not met expectations in Lombok and this has led to a perception that the government is a source of credit and grants but is unable to support longer term development (Patrick et al 2006). This perception has been implicated in the decline of traditional community work activities, informal leadership structures and social capital.

The status and role of cattle in smallholder systems in Lombok has been evolving over the past two decades from that of primarily draft animals to a source of accumulated capital and an asset to be managed to generate income.

The 'cattle business' is becoming more attractive for smallholder farmers because the relative price of other farm commodities (such as rice and other grains) has shifted substantially in favour of beef.

Focus on collective systems

Bali cattle in Lombok are typically managed in either distributed (dispersed ownership and individual management of animals) or community managed systems in which cattle are housed overnight in group kandangs. In the latter, farmers share the task of watching their cattle at night, while animal feeding and care remain the responsibility of each farmer.

Distributed systems account for the majority of NTB's cattle population. Improving the performance of cows in this system is problematic as there is limited, assured access to

bulls and therefore seasonality of calving is difficult to regulate. In many cases, farmers remain 'cattle keepers' rather than 'cattle producers', especially with respect to feed management.

For the minority of the herd based in a collective system, the potential is high to redress productivity constraints associated with improved mating and calving. However, the densely occupied complexes (kandang) tend to be poorly managed, resulting in muddy floors and the accumulation of waste that increases the likelihood and incidence of disease and calf mortality.

There are at least 800 kandang in operation on Lombok island and government agencies are promoting their further development. Kandang have been most readily adopted in areas where cattle density is high and land availability for grazing is low, such as in Central Lombok. Farmers indicate the benefits of the system include better animal security, increased income and ease of observing their cattle.

This project aimed to add value to these existing community structures and to demonstrate that there are significant additional production benefits to be derived from the kandang system.

Addressing productivity constraints

The Indonesian government considers NTB to be a key region that can provide cattle for the growing domestic market, particularly for urban areas such as Jakarta.

However, the productivity of Bali cattle in NTB has been relatively low. Talib et al (2003) reported that the average calving rate in the region was 51.7% whereas Bamualim and Wirdahayati (2003) suggest that Bali cattle have the capacity for calving rates up to 90%. Calf mortality is also high at 15% - the second highest among the five major provinces producing Bali cattle.

According to recent studies (Lisson et al 2008; Dahlanuddin et al 2009) the more important factors associated with this low productivity are limited availability of high quality feeds, limited access to bulls, out of season calving and poor sanitation.

Feed availability Due to the continuing conversion of agricultural lands to housing and urbanisation, cropping areas are getting smaller, and land available for livestock grazing cannot produce high quality forages in sufficient quantity to meet demand. In the more populated areas of Indonesia, such as Lombok, cattle are kept under a cut and carry system, in which the amount and quality of feed offered to cattle depends on the availability of locally derived feed, or the ability of a farmer to collect good feed from outside the village.

Access to quality bulls Limited availability of suitable bulls has been a major contributing factor to the low calving rate for cattle. A survey of kandang groups in Lombok found that of the 486 groups specialising in calf production (breeding), 200 of them did not have bulls (Dahlanuddin et al 2005). As a result, many cows in oestrous are not mated on time or have to be mated with a less suitable bull, which may not be genetically optimal. In groups where bulls are present, sharing bulls is uncommon due to the belief that mating causes weight loss in the bull.

Seasonal calving High calf mortality has been linked to the irregular distribution of calving throughout the year. Cows that calve during the peak of the dry season are at great risk of experiencing malnutrition and, as a result, may not be able to support foetal growth during the final period of gestation. Malnutrition can also result in low birth weight, slow calf growth or even calf loss. Bamualim and Wirdahayati (2003) reported that only 19% of calves in NTB were born from October to March (when good forages are abundant), 41% were born from April to June (when forage is still in relatively good supply and of moderate quality) and 40% were born from July to September (when forage quality and quantity is poorest).

Pen sanitation At the peak of the wet season, high quality feeds are relatively abundant but newly born calves are at high risk of contracting infectious diseases due to wet ground and poor pen sanitation. At the same time, farmers are busy with cropping activities and have little time to spend on cleaning pens or providing better feed to their cattle.

Accordingly, the practices promoted by this project (the 'technology package') are:

- Controlled mating
- Early weaning
- Preferential feeding
- Forage production and use
- Improved infrastructure¹

Building on previous research

This project has as its foundations a series of successful ACIAR projects.

Developing an integrated production system for Bali cattle in the eastern islands of Indonesia (Project AS2-2000-103) addressed productivity issues with four simple, integrated interventions: 1) introduction of a community-managed bull; 2) controlled, seasonal mating so pregnancy and calving aligned with the farming system; 3) weaning calves at 5-6 months instead of the more common 12 months; and 4) tactical feeding of calves, alongside improvements in housing and care.

Optimising crop-livestock systems in West Nusa Tenggara Province (Project AS2-2000-125) built relationships with key stakeholders, developed an understanding of the rainfed crop-livestock production systems through survey, monitoring and observation and developed modelling tools to assess benefits and risks to increasing beef production at a household level.

Improving smallholder crop-livestock systems in eastern Indonesia (Project LPS-2004-005) used farming systems analysis and tools, coupled with a participatory approach to identify and address production constraints. Feasible 'best bet' strategies were developed and trialled on-farm. Farmer feedback and monitoring data indicated that the approach was successful, with results including: quantifiable gains in forage and livestock production, labour savings and gains in household income; the intention of most farmers to continue successful strategies; and evidence of significant adoption/adaption of the livestock improvement technologies by other (non-project) farmers.

Understanding adoption

This project aimed to build on the insights and outcomes of these projects by implementing successful practices into the collectively managed kandang systems of Central Lombok. A research focus is on better understanding the adoption process, particularly how farmers and communities spread information and make decisions on new agricultural practices.

Any farming activity occurs within a system, and is constrained by social (eg culture, institutions), physical (eg land) and economic (eg capital, markets) resources (Giampietro 2004). Changes to one part of the system will most likely have an impact on other parts, ie require adjustments by several elements in the system.

¹ Although not formally part of the project's technology package, improved infrastructure - leading to increased mating opportunities and improved sanitation - was also promoted by the project team. It was considered an important pre-condition for adoption of the package.

In largely subsistent smallholder systems adoption of a new practice is most likely to have an effect on land and labour demands, division of labour, and input/output ratios. In this context, household decision making regarding allocation of these resources is based on a range of factors such as social demands, cultural norms, aspirations and risk perception, in addition to economic factors.

To understand farmer decision making, the project team aimed to understand:

- available social, physical and economic resources that determine the viable options for the household's activities
- household livelihood strategies (eg maximisation of cash income or maintenance of subsistence and use of cattle as contingency resource)
- household evaluation of risk

In addition, the project team aimed to build capacity and positively influence local and regional institutions associated with livestock management.

The Lombok project had a sister project in South Sulawesi. *Building capacity in the knowledge and adoption of Bali cattle technology in South Sulawesi* (Project SMAR-2006-061) which aimed to implement successful livestock improvement practices in the individually managed crop-livestock systems of South Sulawesi.

4 Objectives

The objectives of this project were:

- To improve household welfare by supporting the adoption of better husbandry and feeding practices of Bali cattle in mixed crop livestock systems in Lombok
- To build local institutional and community capacity to support the uptake of improved animal husbandry and feeding management practices
- Build understanding of the socio-economic environment and the constraints and catalysts for the adoption of the project practices.

The expected project outcomes were:

- Lasting improvement to Bali cattle production
- Improved capacity in institutions and communities to support uptake of practices and knowledge
- Widely applicable approaches to adoption

5 Methodology

5.1 Location and site selection

Lombok is one of the islands that make up Nusa Tenggara Barat Province or NTB (West Nusa Tenggara; see Figure 1). Mt Rinjani dominates the island, influencing soil fertility. The volcanic central plains are the most fertile area, while southern and eastern regions are less fertile and drier.



Figure 1. Map of Nusa Tenggara Barat (NTB) province, showing Lombok island. Inset is map of Indonesia showing location of NTB.

Across Lombok, climate is defined by a wet season from around November to March and a dry season from around April to October. Seasonal differences are more pronounced in southerly regions, with regular drought periods (Patrick 2004).

There are eight Regencies or Kabupaten in NTB, each led by a Bupati or local Governor. Each Regency is divided into sub-districts or Kecamatan. Each Kecamatan comprises a number of villages (Desa) and sub-villages (Dusun).

The Kabupaten selected for project activities was Central Lombok (Lombok Tengah).

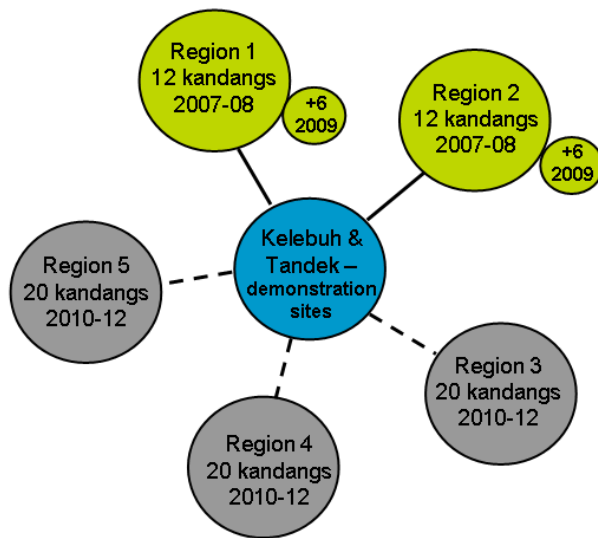


Figure 2. Original plan for expansion of project work (with a five year focus).

The project team originally proposed to select and work with 12 kandangs in each of two regions in Central Lombok in the first two years of the project (see Figure 2). Due to the late start of the project, the schedule was changed.

The first 12 groups were selected in January 2008. These included the demonstration villages of Kelebu and Tandek from ACIAR project AS2-2000-103

The second 12 groups were selected in May 08. One village was dropped from the project in November 09 due to security concerns.

The third 12 groups (plus an extra group) were selected in June 09.

Criteria used for selection of study groups include:

- Security of animals
- Number of cattle and herd structure
- Status of land (security of tenure)
- Distance between kandangs (to maximise bull use efficiency)
- Potential to improve forage production
- Willingness to participate
- Sanitary condition.

Kandang groups were scored and ranked and final decisions made with local Dinas Peternakan staff.

The 36 groups are located in eight kecamatan – Praya, Praya Tengah, Praya Timur, Praya Barat, Pringgarata, Jonggat, Batukliang and Batukliang Utara (refer to Figure 3).

Details of the study kandangs (group name, location, number of farmers, number of cows) appear as Appendix 1.

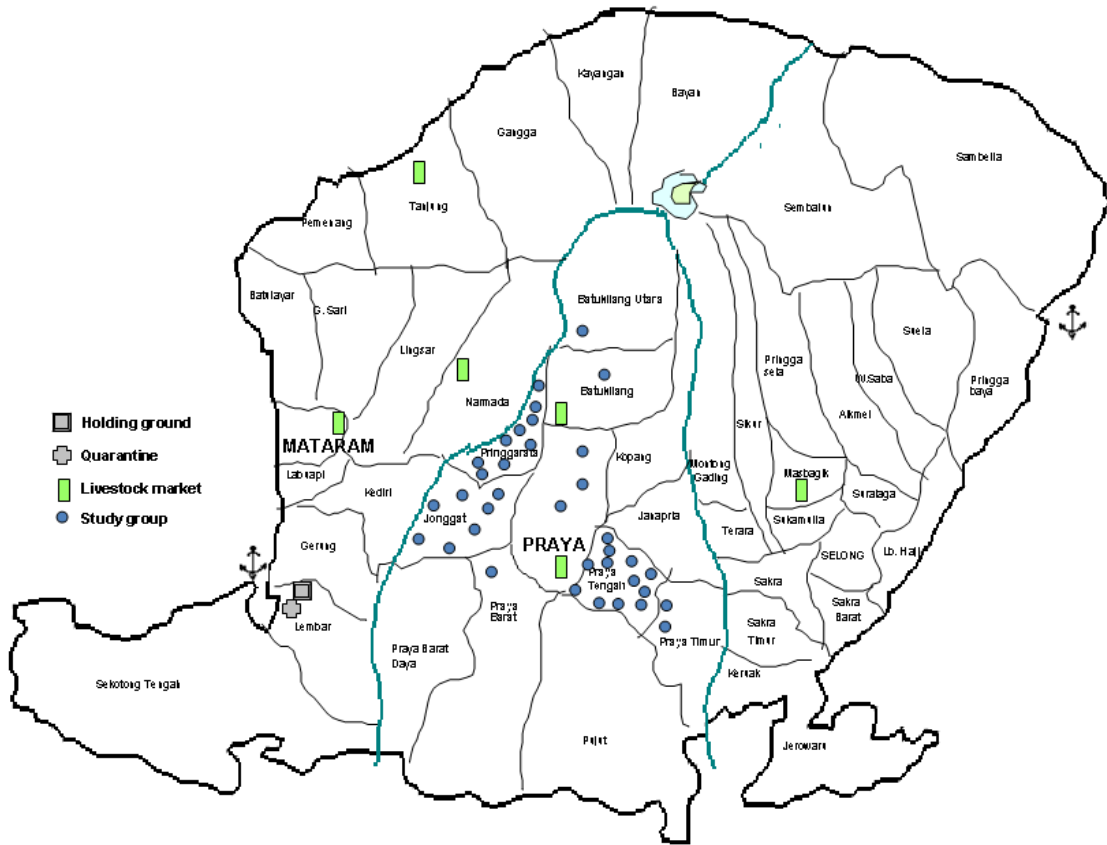


Figure 3. Location of 36 study kandang groups (blue circles) in Lombok Tengah district of Lombok. District boundaries are in light blue.

5.2 Personnel

There were four inter-related teams and two students working on the project.

Project Specialist Team

The Project Specialist Team (PST) was responsible for designing and overseeing research aspects of the project and providing technical support and training to the On Ground Team (OGT). The PST was a multidisciplinary team of Indonesian and Australian researchers with specialist expertise covering cattle nutrition and husbandry, cattle disease management, agronomy, systems research, economics, extension, cultural and social systems research and communication (refer to Table 1).

Table 1. Members of the Project Specialist Team for SMAR-2006-096, their affiliations and specialist expertise

PST member	Affiliation	Specialist expertise
Jeff Corfield	CSIRO	Agronomy, farming systems
Dr Dahlanuddin	UNRAM	Livestock, nutrition
Dr Clemens Grunbuhel (2008-11)	CSIRO	Social research
Hasanuddin	Penyuluhan NTB	Livestock, extension
Neil MacLeod (2007-08)	CSIRO	Resource economics
Cam McDonald	CSIRO	Livestock, farming systems
Dr Shaun Lisson	CSIRO	Farming systems
Achmad Muzani	BPTP NTB	Livestock management
Hermansyah	UNRAM	Socio-economics, communication
Dr Bruce Pengelly	CSIRO	Forage, farming systems
Dr Ketut Puspadi	BPTP NTB	Social research
Prof Yusuf Sutaryono	UNRAM	Farming systems, livestock
Monica van Wensveen	CSIRO	Communication
Liana Williams (2008-11)	CSIRO	Social research
Lalu Ahmad Zaenuri	UNRAM	Livestock reproduction

On Ground Team

A key objective of the project was adoption and a key factor was considered to be effective engagement with farmers. During the design phase of the project, it was agreed that the project would employ dedicated professionals to provide a strong and continuous link with the community, rather than rely on existing agencies.

The OGT was responsible for on ground implementation of project activities including data collection, extension and engagement with farmer communities. The 12 team members were based in Praya, Central Lombok and were assigned to specific study kandang groups for periods of 12 months.

A position description for members of the OGT was developed by the Lombok and Australian teams in July 2007. An advertisement was placed in the local paper and on the UNRAM website in August 2007. A shortlist of applicants was developed (from 140 applications), based on academic achievement, relevant experience and language skills.

Forty candidates underwent a psychological profile test, then an individual interview. Twenty candidates were re-interviewed and 12 individuals were selected in September 2008 (refer to Table 2).

The final group was a mix of recent graduates and recruits with expertise in smallholder farming systems, and comprised skills in socio-economics, animal management, forage management and smallholder farming. All had abilities in the regional language. There has been no change in staffing.

A Project Officer – Lukita Cesaria Ibundani - was also appointed in this recruitment process.

Table 2. Members of the On Ground Team for SMAR-2006-096 and their initial areas of study

OGT member	Initial areas of study or expertise
Lale Erni Sudewi	Animal production
Muhammad Supriyadi	Animal nutrition
Mujiburrahman	Socio-economics in agriculture
Ari Listya Novitasari	Socio-economics in agriculture
Syahrul Zubaidi	Animal nutrition
Lale Kartina Dahari Anjani Arungan	Animal production
Martini	Animal nutrition
Ahmad Afandi	Animal production
Fathul Hayyi	Animal nutrition
Totok B Julianto	Animal production
Agus Heriyanto	Animal production
Murama Hasyura	Socio-economics in agriculture
Lukita Cesaria Ibundani	Animal husbandry, agribusiness

Project Management Team

The Project Management Team (PMT) was responsible for operations, coordination, resourcing and reporting. The composition of the PMT is given in Table 3.

Table 3. Members of the Project Management Team for SMAR-2006-096, their affiliations and roles.

PMT member	Affiliation	Position
Dr Bruce Pengelly	CSIRO	Project Leader - Australia
Dr Ketut Puspadi	BPTP NTB	Project Leader - Indonesia
Dr Dahlanuddin	UNRAM	Project Coordinator - Indonesia
Monica van Wensveen	CSIRO	Project Coordinator - Australia
Lukita Cesaria Ibundani	UNRAM	Project Officer - Indonesia
Lia Hadiawati	BPTP NTB	Project Liaison - BPTP

Program Advisory Committee

The Program Advisory Committee (PAC) was formed in November 2007 from heads of relevant regional and provincial institutions and representatives from NGO, farmer and trader groups (refer to Table 4 for details).

In addition to the core PAC membership, invited guests attended meetings. These include representatives of Antara, JICA, UNRAM, the Ministry of Agriculture and Fisheries of Timor Leste, the SMAR-2006-061 project team and the Expert Advisor to the NTB Governor on natural resources and the environment. In addition, the Lombok PST and OGT regularly attended meetings, along with associated extension officers (PPLs).

Table 4. Members of the Program Advisory Committee for SMAR-2006-096, their affiliations and committee tenures.

PST member	Affiliation	Tenure notes
Dr Bruce Pengelly (Chair)	CSIRO	Complete period
Dr Ketut Puspadi	BPTP NTB	Complete period
HL Wiratmaja (or his representative)	Bupati, Central Lombok	Complete period
M Muhzi	Dean, UNRAM Faculty of Animal Science	Complete period
Dr Dwi Praptomo Sodjatmiko	Kepala, BPTP NTB	Complete period
H Abdul Muttalib	Kepala Dinas Peternakan Propinsi	2007-08
Abdul Samad	Kepala Dinas Peternakan Propinsi	2008-10
Baiq Chaidar Indiana	Dinas Peternakan Propinsi	Complete period
H Sarapuddin	Kepala Dinas Peternakan Lombok Tengah	2007-08
Lalu Syafriari	Kepala Penyuluhan Lombok Tengah Kepala Dinas Peternakan Lombok Tengah	2008-09 2009-10
Marzoan	Kepala Penyuluhan NTB	2009-10
H Saad Husni	Farmer and livestock trader	Complete period
L Aksar Anshori	Pusat Studi Pembangunan (local NGO)	Complete period
L Bayu Windia	Kepala Bappeda Propinsi NTB	2007-08
Dr Rosiadi Suyuti	Kepala Bappeda Propinsi NTB	2009-10
Dr Dahlanuddin	UNRAM	Complete period
Monica van Wensveen	CSIRO	Complete period

Students

The project supported two postgraduate students.

Ir H Mastur completed a Masters degree (with *cum laude*) at UNRAM with Yusuf Sutaryono (UNRAM) and Jeff Corfield (CSIRO) as supervisors. His research was on

forage agronomy of Mulato (*Brachiaria brizantha x ruziziensis cv. mulato*) hybrid and the effect of organic practices. His trials were based at UNRAM university farm at Lingsar and at the study kandang.

His results showed that application of organic fertiliser significantly improves productivity, nutritive value and digestibility of Mulato. The best improvement was achieved with application of organic fertiliser at 10 tonnes/ ha. The results of his experiment have been disseminated to farmers in the study kandang.

Ir Imran M Si began a PhD in 2008 on the impacts of improving availability of improved and local forages on cattle productivity under smallholder conditions, covering aspects of forage composition and quality, preferential feeding and the impact of forage legumes on livestock performance and farmer adoption. Imran’s PhD was through Gadjah Mada University in Yogyakarta, with Dahlanuddin (UNRAM) as a supervisor.

His preliminary results suggest that introduction of improved forages and better use of locally available tree legumes resulted in improved botanical compositions and nutritive values of diets offered to cattle in the study area. Improved forage availability and balance between grasses and legumes improve cow fertility and reduce calf mortality. Feeding tree legumes (mainly *Sesbania grandiflora*) during late pregnancy and early lactation significantly improved calf birth weight and growth rate. Supplementation of the tree legume to newly weaned calves almost doubles the growth rate of the calves.

He was expected to complete his studies in 2011.

5.3 Project methodology

Five project components will be reported on: *Improving productivity* (Section 5.3.1) looks at uptake of project practices and resulting changes in productivity.

Understanding adoption (Section 5.3.2) examines how farming households make decisions about whether to adopt the best bet practices or not, and how information flows through communities.

Spreading information (Section 5.3.3) looks at the factors and activities influencing natural expansion of project practices from kandang groups to satellite farmers.

Measuring impact (Section 5.3.4) looks across the impact chain in Figure 4 to consider the impact of adoption on productivity indicators and the impact of changes in productivity on livelihood indicators. The focus of this component was on impacts from a precursor project, 4.5 years from the start of the project and 1.5 years from the end of the project.

Building and maintaining capacity (Section 5.3.5) focuses on training to meet project objectives and community and institutional engagement to embed successful elements of the project.

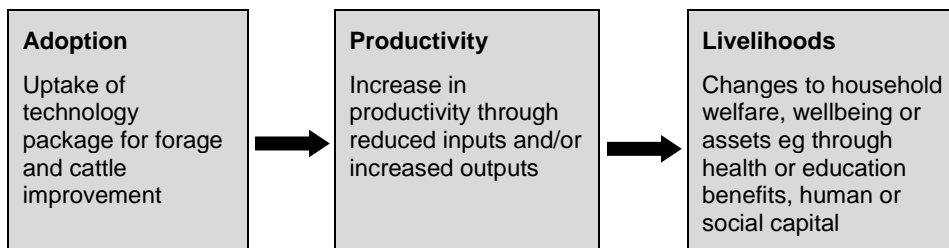


Figure 4. Assumed impact chain and aspirational targets.

Figure 4 shows the impact chain that is assumed in the project. This report will focus primarily on adoption and changes in productivity. A project extension (starting in July 2010) is using indicators and narratives to describe and document changes to farmer livelihoods and these data will be available in the subsequent report.

5.3.1 Improving productivity

Farmer engagement and participatory planning

The first steps to improving cattle productivity were activities related to changing farmer perceptions and persuading farmers of the benefits of adopting the technology package.

OGTs were first introduced to village authorities (eg village head, PPL) in shortlisted farmer groups and the aims and approach of the project were presented. OGTs conducted farming system and social mapping of each village and communicated project activities and objectives to farmers in a group meeting.

The farmer groups were taken to Tandek - a nearby village that adopted practices from the AS2-2000-103 extension project that was in the current project as a training and demonstration village. In a group meeting, farmer leaders from Tandek and the local PPL explained to the visiting farmers the practices and benefits of the program and also the pre-requisites needed to successfully implement the practices and avoid unnecessary risks.

All groups also visited UNRAM's farm at Lingsar to introduce farmers to new forage *in situ* and to discuss and compare growth and performance.

The next step was for OGTs to facilitate a farmer meeting in each group after returning from Tandek. The meeting was to discuss the visit, compare the group's existing performance to that of Tandek and critically reflect on differences between the two systems.

Following this was another meeting to develop plans to improve productivity. Adoption of the entire technology package was encouraged, but generally a step by step process was followed according to the needs of the farmer group.

Key elements of the plans were the participatory purchase of the bull and agreements on bull management. Before purchasing the bull, group agreements were sought to establish: a) which farmers were skilled and willing to go to the market to select and buy the bull, b) who should manage the bull; c) what mating fees to apply to group members and non-group members; d) what proportion of mating fees and profit from selling the bull should be contributed by the bull keeper to group savings; and e) how the group can generate enough money to buy a good bull the following mating season.

Other key elements of the group plan were strategies to improve supply and quality of forages.

The technology package

The four practices promoted by the project team (the technology package) were:

- Controlled mating: Mating at 40 to 60 days post partum with a quality bull, to ensure calf drop at the best time of year with respect to forage, ground condition and farmer activity
- Early weaning: Weaning at between 5 and 7 months
- Preferential feeding: Feeding cows in late pregnancy, lactating cows and newly weaned calves the best quality forage available, including the introduction of legumes to the diet
- Forage production and use: Optimising the use of existing forages (especially *Leucaena leucocephala* and *Gliricidia sepium*) and introducing improved forages to the farm system. Initially, demonstration plots of 100-300 sq m were established (from Lingsar cuttings and project seeds) near each kandang so kandang and satellite farmers could observe growth; these plots then became source plots for sharing of resources.

Although not formally part of the project's technology package, improved infrastructure – allowing for increased mating opportunities, improved sanitation and better feeding management – was also promoted by the project team. It was considered an important pre-condition to support adoption of the package.

Benchmarking and monitoring

A benchmarking survey was developed and trialled in January 2008. Information gathered included: farm system information (eg cropping, cattle, inputs), a calendar of activities, farmer profile information (eg age, education, land ownership), a kandang profile (eg kandang establishment, number of members), data on existing productivity and information about gender issues. The benchmarking questionnaire appears as Appendix 2.

The benchmarking surveys were completed for the first 12 kandangs in February 2008 and for the second 12 kandangs in July 2008.

The survey was reviewed and revised in June 2009. Interviews for the third 12 kandangs were completed in July 2009.

Each OGT was assigned to a particular kandang (working with three kandangs each by year three) for a period of one year, after which all OGTs were re-assigned. OGTs visited their assigned kandangs at least three times a week - often daily – and maintained a series of monitoring logbooks or diaries. Information regularly collected included: animal data (eg weight, condition, reproductive status), mating management, pedigree (eg sire and dam of each calf), calving and weaning information, animal health and herd dynamics.

Information was also recorded about the dynamics of the kandang group, individual farmer issues and adoption of project practices.

In addition, the PMT and OGTs held an annual meeting with leaders from each kandang group to reflect on progress.

In November-December 2009, a survey was conducted of farmers from the first 23 kandangs to gather information on adoption and impact. An additional survey was conducted for satellite farmers in May 2009.

5.3.2 Understanding adoption

One of the key research aims of this project has been to understand processes of household decision making and information dissemination as a means to better understand adoption.

To understand the household decision making processes that determine whether or not adoption takes place, detailed 'adoption' and 'non-adoption' narratives were collected. These provided insights into the livelihood strategies of households as well as the steps in the decision making process. Narratives were developed from in-depth interviews in four case study kandangs. Interviews explored what factors were considered in the steps of deciding whether or not to introduce the suggested practices, as well as other influential factors.

To facilitate comparison across locations and contexts, interviews were loosely structured according to Geertz' (1975) and, more specifically, along the analytical framework described in Section 7.2 (see Figure 5).

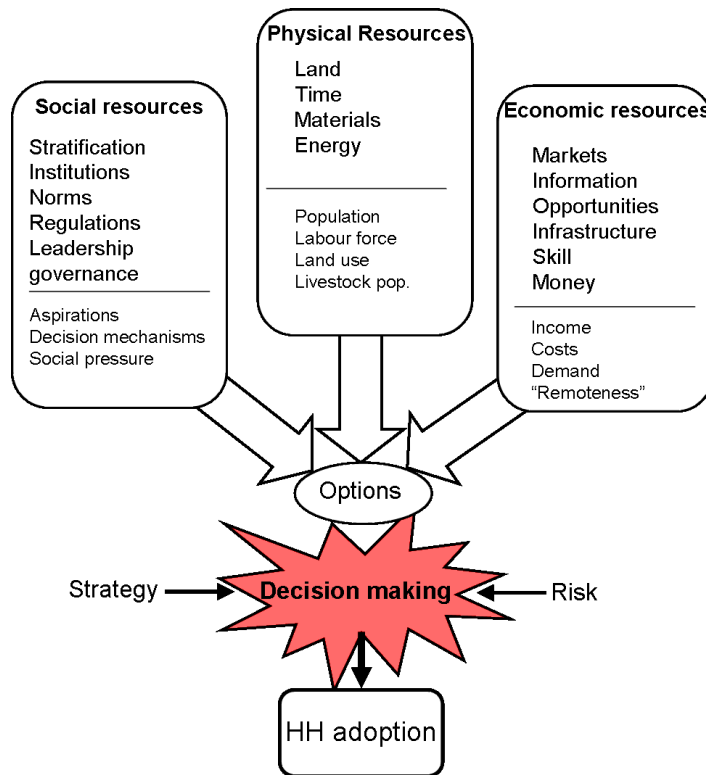


Figure 5. Household decisions are framed by available resources, livelihood strategy and perceptions of risk.

The decision to adopt new practices does not occur in isolation of social relationships. While knowledge of the new practices is necessary for adoption to occur, it is assumed that households do not consider this information in isolation.

Rather, there is a process of (formal or informal) exchange with other actors or institutions such as neighbours, village heads, religious leaders, government agencies – all of whom feed into the decision making process.

Thus, for development interventions to be successful, attention needs to be paid to accessing and building links with existing networks (Mahanty 2002).

Social Network Analysis (SNA) was used in this research to examine how knowledge about the practices spread between households and communities as well as information about what type of households, relationships or institutions were critical for promoting adoption.

In this case, SNA was used to examine how knowledge about the practices spread between households and communities as well as information about what type of households, relationships or institutions were critical for promoting adoption. Data collection focused on capturing:

1. Interactions and influence between households and institutions (eg Who do households go to for advice and information?)
2. The spread of information (eg If households are using any of the new practices, how did they find out about them and who have they discussed them with?)
3. The spread of associated resources

The networks were constructed by using data extracted from the narrative interviews, and visualised using Netdraw 2.097 (Borgatti, 2002). In most cases, the interviews for decision analysis and networks were conducted simultaneously. While this served a pragmatic purpose, it also meant the information provided in the networks could be supplemented with narrative information.

The two methods - decision and network analysis - allowed the project team to observe the broader institutional and social context (eg culture, social norms) as well as individual perceptions, judgements and emotional aspects of processing information within the community. Hence, the results not only contain a formal analysis of relations between actors but also reveal the process of evaluating risks and adapting livelihood strategies as the household environment is changed through project intervention.

Case study selection and sampling strategy

Four case studies were chosen to be the focus of this research component. By focusing research efforts on a limited number of sites, it was possible to gather detailed data and

thereby gain a fuller understanding of decision making (rather than a range of data at a more general level, across all sites).

Case studies were selected by looking at the project kandang groups as a starting point (see Table 5). Criteria for selection of kandangs were:

1. Kandang groups were among the first 12 to be involved with the project (allowing for longer timeframes and greater potential for change)
2. Sites reflect varied rainfall across the region
3. Sites reflect a mix of government established and community established kandangs
4. Selected kandang groups are located within a sub-village and there is another non-project kandang group nearby.

Table 5. Case study kandang group characteristics

Kandang Group	Sub-village, village	Characteristics
Case study 1	Pengembuk, Kelebu	Lower rainfall, generally more extensive systems, non-government group
Case study 2	Montong Pentil, Batunyala	Lower rainfall, generally more extensive systems, non-government group
Case study 3	Tandek, Labulia	Better rainfall, more intensive systems, non-government group
Case study 4	Dasan Baru, Ubung	Better rainfall, more intensive systems, government established group

Note: For ease of reading, case studies will be referred to by their village name

For each case study, OGTs interviewed four kandang group members. In each interview, farmers were asked to identify four other people they had discussed project practices with – either satellite farmers, farmers from another kandang group or non-adopters. OGTs then interviewed these farmers (total of 20 interviews per case study).

The original sampling strategy was to interview a larger number of households and include a number of random households who may or may not have been exposed to the project in order to contrast their experiences (distinct to satellites who have at least trialed a project practice).

However, operationally this was not possible and adjustments were made. The scaled-down sampling strategy has meant some aspects of analysis are limited. This meant more conventional SNA methods were not used. However, the method of data collection and visualisation proved to be a valuable tool to discuss information flow and relationships with the OGTs.

There was no deliberate strategy in terms of interviewing equal numbers of men and women, as the focus was on household rather than individual perspectives. As a result there was a strong bias towards male respondents. This is largely because the interviewee was generally the head of the household, which is traditionally a male role in this society.

Interview narratives suggested a reasonable level of consultation between men and women in the household. However it was not possible (in the scope of these interviews) to study more closely how or whether decisions and impacts of adoption were viewed differently by men and women in a household.

Interviews were conducted by the OGTs after intensive training on social research methods by PST members. OGTs summarised the interviews and completed Social

Network Analysis tables. Data analysis was coordinated by the Australian PST, in close collaboration and consultation with the OGTs.

5.3.3 Spreading information

Scaling out information from kandang groups to satellite farmers was not a priority for the project. Nevertheless, natural expansion of project ideas occurred and this section looks at factors and activities influencing dissemination through farming communities.

Satellite farmers are those farmers in close proximity to the selected project kandangs. They are not members of the kandang group. As an example, Figure 6 gives a representation of the relationship between Anugrah kandang and its satellite farmers.

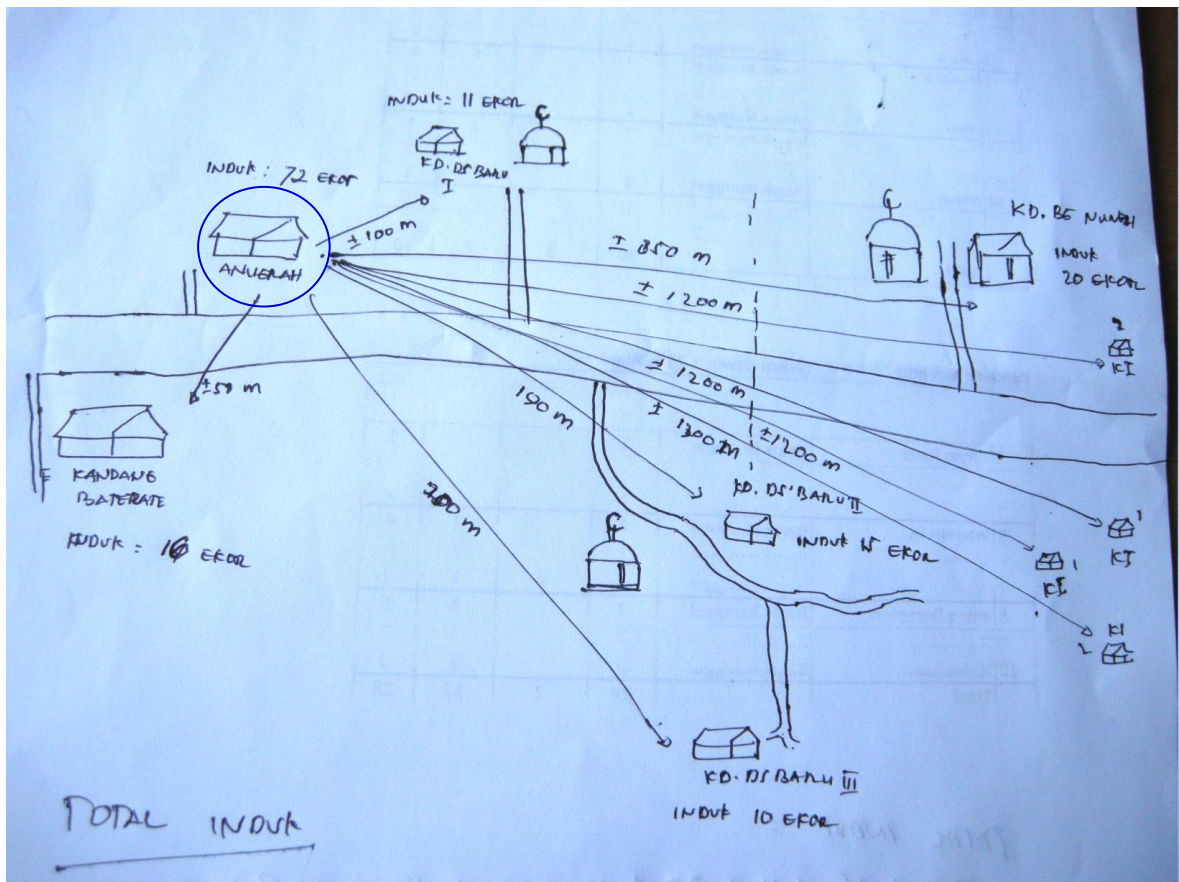


Figure 6. Schematic map of Anugrah kandang, showing location and distance of satellite farmers and number of cows serviced by the Anugrah bull in 2008. Map developed by OGTs, in consultation with farmers and village leaders.

Three sources of information are used to examine spread of information.

1. A survey of 385 satellite farmers was conducted in May 2009. The focus of the survey was on adoption of project practices and transfer of information.
2. Information was gathered from satellite farmers in July 2009 as part of the farmer narrative activities described in the previous section. Aspects of information flow through the community are discussed.
3. Expert opinion on constraints and drivers for scale out and adoption was collected in mid 2009 as part of the project's annual coordination meeting. A summary of responses from OGT and PST members appears in Appendix 3.

5.3.4 Measuring impact

The focus in this section is on analysis of data collected from participating farmers from a precursor project (005 project). In particular, the project team aimed to trace impact from adoption of project practices through changes in productivity to changes in livelihoods.

As the 005 project began 4.5 years earlier, it was felt that revisiting participating farmers would provide an opportunity to follow this impact chain. In addition, discussions with 005 farmers were conducted 1.5 years after the end of the project, thus reducing the effect of ongoing project team activities.

Forty-one farmers participated in the 005 project with activity was conducted at four sites in eastern Indonesia (refer to Lisson et al 2008 for details):

- SPA village in Sumbawa, NTB
- Mertak village in southern Lombok, NTB
- Lompo Tengah, Pattappa and Harapan villages in Barru Regency, Sulsel
- Lemoa and Manyampa villages in the Manuju subdistrict of Gowa Regency, Sulsel.

As part of the current project, interviews were conducted in October 2009 with 30 out of 41 farmers from the 005 project. Interviews were conducted by members of the Indonesian and Australian teams in all previous project sites except for SPA.

Results of October 2009 interviews were compared against information from 005 project start up interviews (March 2005) and exit interviews (February 2008). This enabled analysis of changes since the project had officially ceased as well as cross checking previously gathered information.

These data reflect impacts felt by farmers in dispersed systems, rather than collective systems, making direct comparisons and trajectories for this project's (096) farmers difficult. However, this information does provide an indication of what impacts and changes can be expected by individual farmers adopting similar project practices.

A detailed analysis of the extent to which productivity impacts extend to increased livelihood security will form the basis of the report for the 096 project extension (due for completion in mid-2011).

5.3.5 Building and maintaining capacity

In this component, the project team focused on three key activities: training and capacity building for OGTs, knowledge transfer with farmer groups and communities and embedding project principles into regional initiatives and priorities through institutional engagement.

OGT capacity

In the first and second years of the project, a series of theoretical and practical training sessions were conducted by Indonesian and Australian PST members. These sessions focussed on equipping OGTs with knowledge and skills needed for their role in the project. Table 6 gives details of training topics.

Local PPLs from the project's study villages were invited to most training sessions. This was seen as a useful training, team building and capacity building exercise, although attendance was irregular.

Table 6. 'Formal' OGT training activities conducted by PST members in 2008 and 2009.

Training sessions in 2008	Training sessions in 2009
Forage training, including monitoring, quality, sampling, nursery establishment and maintenance, and feed budgeting	Data collection and analysis techniques
Introduction to the Integrated Analysis Tool	Kandang sanitation and infrastructure development
Controlled mating, bull selection and weaning	Detection of oestrus
Cattle feeding and nutrition	Social research training, including decision making narratives and social networks
Cattle husbandry and reproduction	Basic training in livestock health
Strategies for interaction and capacity building for farmer groups	Use of manure as an organic fertiliser
Strategies for selection of farmer groups	Farmer group development
Collecting socio-economic benchmarking data	Problem solving

In addition to 'formal' training, the Lombok team conducted 'Saturday School' for OGTs for the duration of the project. Saturday School comprised informal training, review and planning, general discussion and problem solving. Sessions were led by PST members, students or OGT members.

All training activities were evaluated by the OGT in May 2008 and May 2009. Capacity building across the whole project was reviewed and evaluated by the OGT and PST in May 2010.

Community capacity

There were no formal training activities for farmers or communities during the project. Skills and knowledge were transferred in a number of ways, primary amongst them were:

- Working alongside OGT members
- Engaging with PST members
- Interacting with participating project farmers

In November-December 2009, a survey was conducted for the first 23 kandangs to gather information on adoption and impact from the farmers' perspective.

In May 2010, OGTs and PSTs were asked for their views on significant changes to farmer skills and knowledge as a result of participating in the project.

In June 2010, farmers from a subset of villages (Sumber Rejeki, Montong Pentil and Laju Rena) were asked to assess the process and impact of the project on their farm systems, management and capacity.

Institutional engagement

Towards the start of the project, the project team developed a list of government and other institutional groups with whom they planned to engage, with a goal to embed successful elements of the project into regional and local institutions and policy (see Table 7).

A cornerstone of this institutional engagement strategy was participation on the Program Advisory Committee, in which key players with common interests interacted on a regular basis. At their first meeting, the PAC defined their role as providing overall guidance and advice on the direction and relevance of the project.

Meetings comprised an update on project progress, followed by discussion on the relevance to regional initiatives and suggestions for additional or synergistic activities. The

PAC met formally in November 2007, July 08, October 08, February 09, June 09, October 09 and June 10 and a summary of minutes are provided as Appendix 4.

Alignment with regional initiatives was deemed vital by the project team. Two important opportunities arose: 1) the Central Lombok Calf Harvest in October 2009 in which the project team was able to support this highly successful Dinas-led event; and 2) the formation of a task force in December 2008 to develop NTB's vision to be the Land of a Million Cattle - the Project Leader and Coordinator were invited to join.

Other activities were either serendipitous or responsive, particularly requested briefings and participation in meetings with local and regional stakeholders. Communication and liaison of the Lombok Program Leader and Coordinator has been paramount to success in this area.

Table 7. Institutions and groups with whom engagement was sought by the project team on the issue of increasing livestock productivity in mixed systems in Lombok.

Level of influence	Institute or group	Reason for engagement
Provincial (NTB)	Dinas Peternakan	Custodian of provincial livestock policy; input into provincial planning on livestock issues
	Extension Office*	Responsible for delivery of agricultural information to farmers
	Bappeda	Provincial planning and funding across all sectors
	Governor's office	Provincial planning, policy and funding across all sectors
District (Central Lombok)	Bupati's Office	Responsible for activities of Dinas and Extension at district level
	Dinas Peternakan	Implement provincial livestock policy; engage with farmers on technical livestock issues
	Extension Office*	Engage with farmers on agricultural issues; potential custodians of knowledge and skills post-project
External	Other research groups	Synergies between projects; shared resources and information
	NGOs	Potential dissemination of information and skills

* Note that the Extension Office only gained prominence in early 2009 when it separated from the Dinas technical office to become its own institution.

In May 2010, Lombok PST members completed an exercise looking at how the project had influenced major institutional and government initiatives and policies around livestock improvement since the start of the project.

In addition, PAC members were asked to provide input on the success and relevance of the project for their respective institutions, and to suggest areas of future work.

6 Achievements against activities and outputs/milestones

Objective 1: To establish project foundations and begin operational activities

no.	activity	outputs/ milestones	completion date	comments
1.1	Establish management committees; develop terms of reference	PMT, PST and Program Advisory Committee (PAC) established; Terms of Reference for PAC established	Nov 07	<p>The Lombok Program Advisory Committee was formed in November 2007 from heads of relevant regional institutions and representatives from NGO, farmer and trader groups.</p> <p>At the first meeting, the role of the PAC was defined as providing overall guidance and advice on the direction and relevance of the project. Terms of Reference were also agreed.</p> <p>PAC met formally in Nov 07, July 08, Oct 08, Feb 09, Jun 09, Oct 09 and June 10.</p> <p>PMT met at least once every two months, for review and planning discussions, in addition to day to day contact.</p>
1.2	Establish working capital fund	Working capital fund established	Nov 07	A working capital fund was established early in the project and was administered by the Lombok PMT and Project Officer.
1.3	Select, appoint On-Ground Teams	OGTs recruited and assigned to study kandangs	Nov 07	<p>A position description was developed by the Lombok and Australian teams. An advertisement was placed in the local paper and on the UNRAM website in Aug 07.</p> <p>Initial selection was based on academic achievement, relevant experience and language skills and a shortlist developed.</p> <p>Forty candidates underwent a psychological profile test, then an individual interview. Twenty candidates were re-interviewed and 12 OGTs were selected in September 08.</p> <p>There has been no change in staffing.</p>

1.4	Select study villages	Appropriate villages selected	Jan 08 May 08 June 09	<p>Criteria used for selection of study villages include security status, number of cattle, herd structure, status of land, potential to improve forage production, willingness to participate and sanitary condition. Villages were scored and ranked and final decisions made with local Dinas staff.</p> <p>The first 12 groups were selected in Jan 08.</p> <p>The second 12 groups were selected in May 08. One village was dropped from the project in Nov 09 due to security concerns.</p> <p>The third 12 groups (plus an extra village) were selected in June 09.</p>
1.5	Develop incentive/performance scheme	Incentive scheme developed	Incomplete <i>Proposed Sep 07</i>	Development of an incentive or performance scheme for OGTs was not completed. Once the OGTs were in place, it was no longer considered necessary by the Lombok or Australian PMT.

Objectives 2 and 5: To develop OGT training program and implement training

no.	activity	outputs/ milestones	completion date	comments
2.1	Develop training material from previous projects	Training modules and material developed in two languages.	Ongoing throughout project <i>Proposed Dec 07</i>	Training material was developed on an as-required basis, to align with training activities; a useful body of reference material now exists.
2.2	Develop training program with focus in year one and ongoing over three years.	Training strategy developed and linked to incentive scheme	Commenced Jan 08 - ongoing throughout project	<p>A needs analysis for training was conducted by the Lombok PST in Jan 08 and a six month training program was developed for OGTs.</p> <p>This plan was reviewed and revised twice a year according to existing and upcoming project needs and to agreed development and institutional needs.</p>

5.1	Theoretical and practical training for OGT & village extension staff	Increased skill and performance levels	Commenced Nov 07 – ongoing throughout project	<p>'Formal' project training in year one focussed on forage establishment, site selection, animal reproduction, use of agricultural models, data collection, liaison and negotiation techniques.</p> <p>Formal training in year two focussed on further implementation of project activities, such as forage management and feed budgeting, kandang sanitation, nutritional requirements and detection of oestrus.</p> <p>Formal training in year three focussed on social research skills and impact assessment. By this time, OGTs were delivering training to other groups in Lombok and NTB on project practices. PPLs were encouraged to attend all formal training sessions, but few were able to attend.</p> <p>Evaluation of training was undertaken in May 09 and again in May 10 (details in Section 7.5).</p>
5.2	Ongoing training and regular meetings	Timely communication between PST & OGT on training & field activities	Commenced Nov 07 – ongoing throughout project	<p>OGT 'Saturday School' was established in year one, providing weekly opportunity for both training and communication, although there is already high level of interaction between these groups.</p> <p>When in Lombok, Australian and Sulawesi team members joined Saturday sessions.</p>

Objectives 3 and 4: To collect data on farming systems and practices and social-economic status

no.	activity	outputs/ milestones	completion date	comments
3.1	Interview farm households in study kandangs to establish benchmark	Database of benchmark data developed	Feb 08 Jul 08 Jul 09	<p>Benchmark survey developed and trialled in Jan 08.</p> <p>Interviews completed for initial 12 study communities in Feb 08; data collated and entered into central database Mar 08.</p> <p>Interviews for second 12 communities completed in Jul 08; analysed Oct 08.</p> <p>Benchmark survey reviewed and revised Jun 09. Interviews for third 12 communities completed in Jul 09; analysed Jan 11.</p>
4.1	Interview farm households in study kandangs to monitor changes in practice and impact	Ongoing measurements of impacts of change	Ongoing (years 1-3)	A framework for social research on adoption (decision-making and social networks) was developed and finalised in April 09. Training in methodology was conducted in June 09; data collection was in Jul 09.

Objective 6: To conduct field extension and scale-out activities in kandang

no.	activity	outputs/ milestones	completion date	comments
6.1	Extension implementation, monitoring and evaluation in study kandang	Adoption & maximum impact of technologies by farmers; measurements & understanding of adoption & constraints	Ongoing from Mar 08 (proposed)	<p>Across the 36 kandang, adoption rates for farmers at the end of 2010 were:</p> <ul style="list-style-type: none"> • 100% (with cows) used the services of the project bull • 73% adopted 40-60 days post partum mating • 66% adopted preferential feeding for pregnant cows • 42% adopted preferential feeding for lactating cows • 38% adopted preferential feeding for weaned calves • 60% adopted early weaning • 34% introduced mulato (as indicator of forage management, although this does not take into account resource limitations eg available land) <p>1144 farmers in kandang groups and 400-500 'satellite' farmers adopted at least one project practice.</p>

7 Key results and discussion

7.1 Improving productivity

Summary

A specific aim of the project was to initiate and support the adoption of better feeding and herd management of Bali cattle in mixed crop livestock systems in Lombok. This section reports on the uptake of the suite of project practices (the technology package) and resulting productivity changes.

Introduction of a project bull (and the means to sustainably manage it) led to all project farmers adopting controlled mating. Uptake of other animal management practices increased over time. Adoption of forage management practices was constrained by land ownership, but there was considerable uptake of new forage and better management and use of existing resources. The project’s contribution of seed funding and support for kandang renovation resulted in major improvements in hygiene and drainage.

Adoption of project practices resulted in significant increases in selected productivity indicators. In essence, the project’s stated aim of ‘one cow, one calf, one year’ has almost been realised in a period of around 2.5 years. On average, the calving rate was 87% (with 95% calf survival) and the calving interval is just over 12 months.

While herd size has remained relatively stable, births and sales have increased. Farmers are able to sell animals at a younger age because the weight gain between birth and weaning has increased. This strategy works for farmers who have limited space in existing kandangs to house new animals and little additional land to grow forages to feed them.

In this way, farmers are realising their objective of increasing reproductive potential and converting this to greater throughput and increased sales without overt strain on resources.

7.1.1 Uptake of project practices

The project engaged predominantly with smallholder households belonging to kandang groups in Lombok Tengah. The project team promoted a technology package, comprising five key practices (see Section 1.1.1 for details). In the impact chain is represented in Figure 7, this section focuses on adoption of practices.

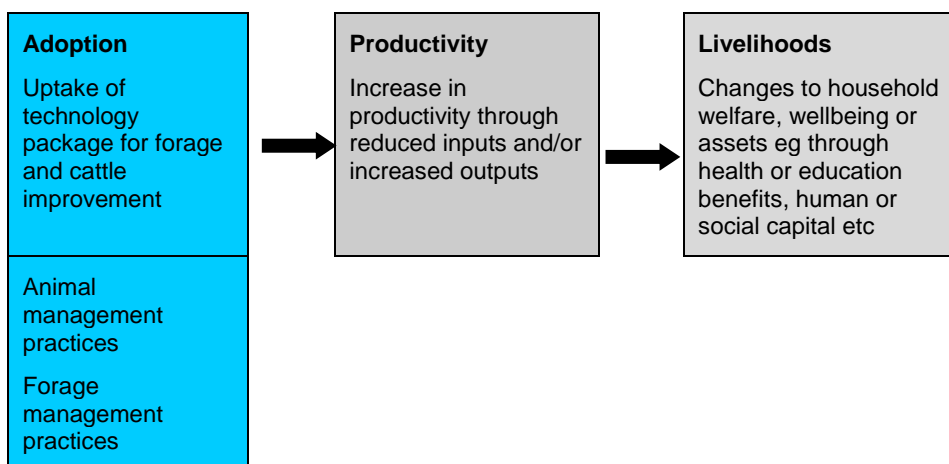


Figure 7. Assumed impact chain, for the project, with a focus on adoption of practices.

The provision of a bull and funds to improve infrastructure to the study kandangs has led to all project farmers using the services of a quality bull and all groups improving kandang infrastructure. It should be noted that implementation of these practices are essentially driven by the kandang group as starting points for participation in the project.

Early weaning and preferential feeding are both individual farmer decisions.

Forage production is governed partly by the individual farmer (if he or she has access to enough land for forage production) and partly by the group (in areas with less available land, communal activities are necessary and more common).

Uptake of animal management practices

Uptake of animal management practices suggested by the project increased over time. The longer farmer groups were exposed to the practices and given assistance in understanding and implementing them, the higher was the proportion of farmers trialling practices.

In the first six months of exposure to the project (ie the newest group to join the project, shown by green bars in Figure 8), around 10-30% uptake was achieved for most animal management practices. This increased to 40-60% after a year with the project (red bars) and 45-75% after 18 months (blue bars).

There was a higher uptake of animal management practices than forage management practices.

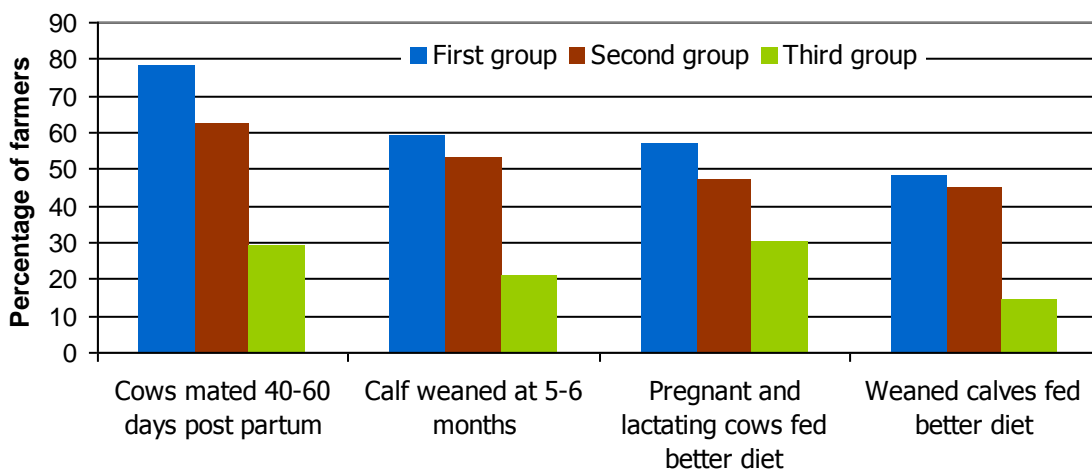


Figure 8. Percentage of farmers that had implemented new animal management practices by end of 2009. At this time, the third group (starting in June 09) had been with the project for around six months; the second group (starting May 08) for around 12 months; and the first group (starting January 08) for around 18 months. The values are averaged across the 12-13 farmer groups that joined the project each year. Note that all farmers (100%) used the services of the project bull.

Uptake of forage management practices

Uptake of forage management practices varied between and within different year groups – only the mean for each year group is presented (Figure 9).

One of the major impediments to adoption of forage practices is land ownership. Around 37% of participating farmers have no land on which to grow forages, and the proportion of farmers with land varied between the groups.

However, 30-40% of farmers started growing new grasses along bunds or in backyards, with Mulato and Panicum (*Panicum maximum*) preferred by farmers due to their quick growth and high leaf to stem ratio.

Elephant grass (*Pennisetum purpureum*) is already in the farming system in this region and 30-70% of farmers expanded their area of elephant grass during the project.

Most farmers (50-60%) were growing Sesbania (*Sesbania grandiflora*) along their bunds before the project and continued to use it as a forage. Additionally, 10-30% of farmers planted and/or commenced using Gliricidia or Leucaena as forage.

In general farmers preferred grasses over legumes because they are easier to establish and grow more quickly.

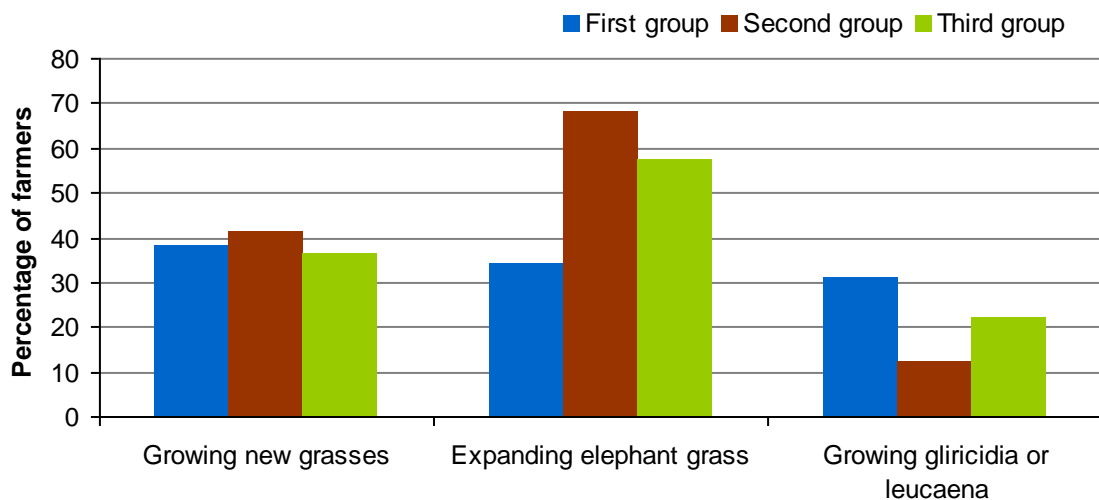


Figure 9. Percentage of farmers who had implemented or expanded forage management practices by end of 2009. The values are averaged across the 12-13 farmer groups that joined the project at each time period.

Uptake of multiple practices

In all groups, more farmers implemented multiple practices than just a single practice (Figure 10), even in their first year of involvement with the project.

There is little other pattern to these data, suggesting that period of involvement with the project is less influential to adoption of practices than other factors, such as group dynamics, location of kandang and access to other opportunities and resources.

Of note is that by the end of the project, less than a third of farmers in any group had adopted the entire technology package.

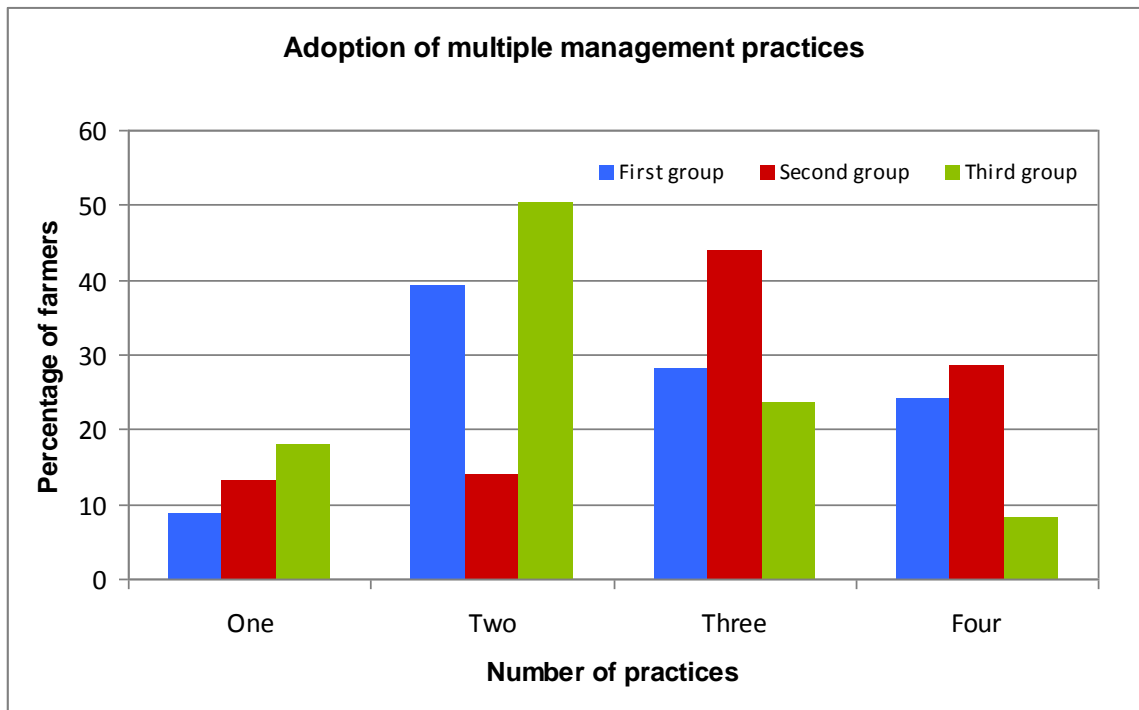


Figure 10. Percentage of farmers that had implemented multiple project practices in each group by mid 2010. The values are averaged across the 12-13 farmer groups that joined the project each year. Non adoptions are excluded (negative responses for animal management may be misleading if farmers do not own a cow or calf).

Infrastructure improvements

Although not formally part of the technology package, considerable effort was invested by the project team to work with farmers on improving kandang infrastructure, with two main aims – improving hygiene and establishing a secure pen for mating.

At the start of the project, pens typically had dirt floors and poor drainage, and some had no or leaking roofs. At best, this resulted in a layer of manure, urine and feed refusals covering the floor. During the wet season, this was compounded by a layer of mud which was often ankle deep. In addition, central laneways between pens tended to accumulate mud, water and waste. This poor sanitation posed health issues for both the animals and the community living around the complex.

Infrastructure improvements were made in every project kandang, even those initiated by the government. Members of the kandang groups decided infrastructure priorities, details of which are provided in Appendix 5. All groups constructed a mating and weaning yard and a weighing platform. All but five groups improved flooring and drainage. Other improvements included construction of feeding boxes, concrete laneways, roofs and improved fencing.

Figure 11 shows an example of conditions at one kandang (Embel Bao) before and after project involvement. Drainage and hygiene were greatly improved by either concreting or using bamboo corduroy to provide better drainage to pens and the central laneway (bottom row), and repairing the roof to prevent rain pooling in dirt floored pens.



Figure 11. Condition of kandang Embel Bao prior to improvements (top) and in February 2010 after improvements (bottom), stalls (left) and central laneway (right).

The project provided seed funding, extension and advice and the kandang group provided labour and additional finances. The level of farmer contribution varied between groups (see Figure 12). Funding provided by the project also varied between groups, but rarely exceeded five million Rupiah. In many cases, the group contribution far exceeded that of the project (ie more than twice as much as the project contribution).

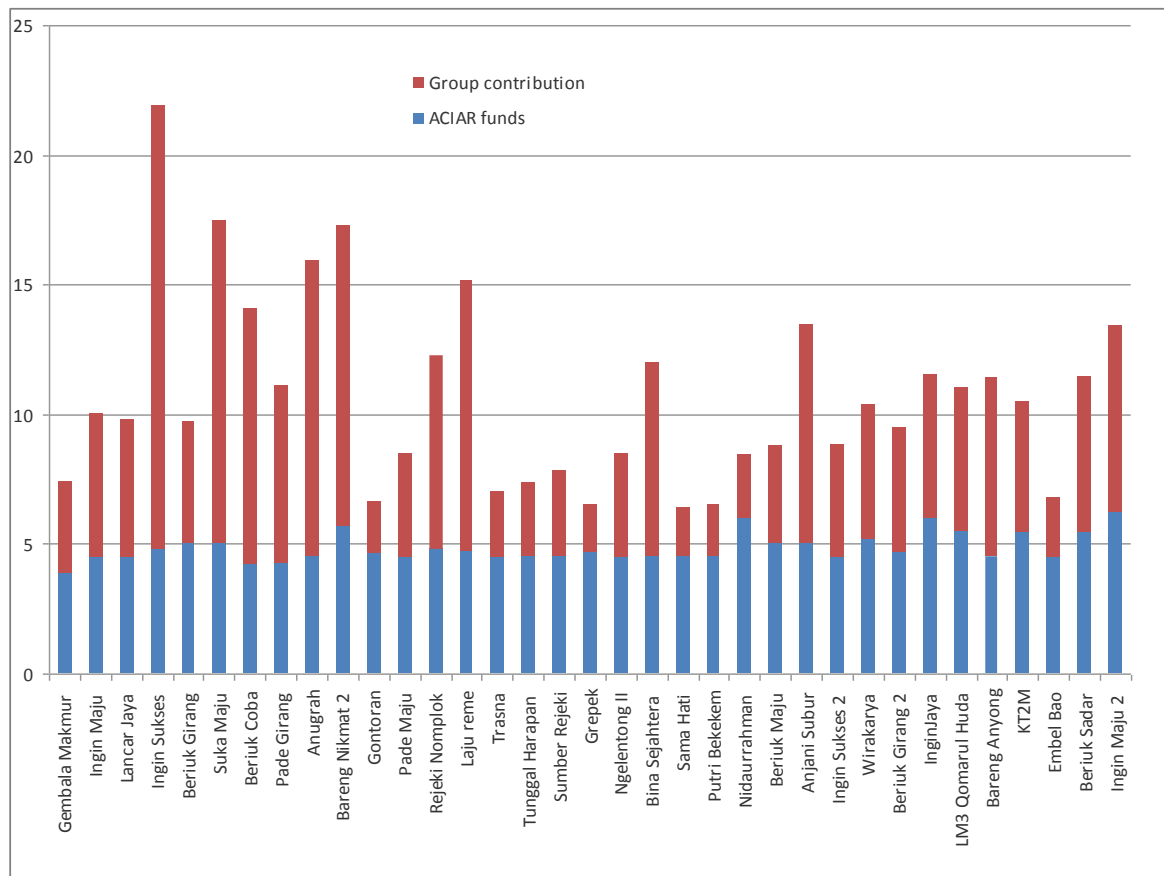


Figure 12. Contribution (million rupiah) to infrastructure improvements for all 36 kandangs. Funds provided by project are shown in blue; funds provided by the kandang group are shown in red. Note that Jaya Gembala is not included.

Box 1 gives an example of how negotiation, reflection and good leadership can positively affect farmer motivation and cooperation.

Box 1. Infrastructure improvements: A case study of Bareng Nikmat 2 (Montong Ubuq).

One of the biggest hurdles for farmers in adopting the recommended management strategies is lack of capital for creation of facilities such as mating and weaning pens, improved drainage and feed troughs.

Because the project has limited resources, farmer participation is essential to improve these facilities. This is hampered by 1) the common perception of farmer groups that they have no resources to contribute; and 2) the development of a renovation plan by most farmer groups that requires a large amount of money.

The project strategy for negotiation of funds and farmer motivation included 1) a good communication plan in which OGTs explained the financial benefits of adoption in terms of cattle health, growth and nutrition; and 2) a visit by new farmers to a demonstration village to enable farmer-to-farmer communication about potential benefits, and often to foster friendly competition.

Infrastructure change in Bareng Nikmat 2 has been dramatic. At the start of the project, its sanitation condition was very poor and the topography of the kandang is the most difficult to work in.

After negotiations between the OGTs and the group, it was agreed that the project would contribute Rp 5 Million to purchase external materials such as cement, nails and roofing and during the renovation process, an additional Rp 700,000 was added.

Farmers initially contributed more than Rp 11 Million in the form of labour and materials (eg bamboo, stones, sesbania trunks). Not through lack of effort of the farmers, the infrastructure improved, but was still among the worst of all the kandang – a fact that was noted at an evaluation meeting between leaders of all 36 kandang groups and the project team. The group leader took this to heart and began to search for ways to increase funds, leading by example.

In the final year of the project, the group collected more than Rp 500,000 from each farmer, resulting in more than Rp 20 Million in additional funds to further improve infrastructure. At the time of writing, the renovation is not yet complete, but the farmers are proud of the improvements already made and are starting to feel the effects in terms of increased productivity.

7.1.2 Indicators of productivity change

The key indicators of improvements in productivity used in the project are shown in Figure 13. All have improved across the project groups.

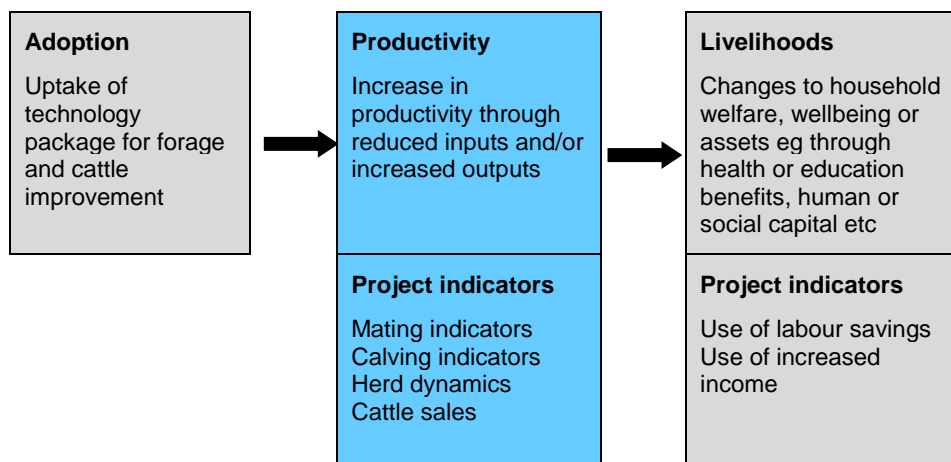


Figure 13. Assumed impact chain for the project, with a focus on changes in productivity

In the first six months of the project, the Indonesian project team developed what became a very effective slogan for the project aspiration and approach – ‘Satu induk, satu anak, satu tahun’, or ‘One cow, one calf, one year’.

This encompasses the objectives to shorten the inter-calving interval (by controlled mating), increase productivity (through better nutrition) and increase longevity (through health and nutrition).

Consequently, there is a particular focus on productivity indicators for increased reproductive outcomes.

Mating indicators

Over 1000 cows were mated by project bulls in the first two sets of kandang groups (n=23 kandangs) and their surrounding satellites in both 2008 and 2009 (Figures 14 and 15). Over 500 cows were mated by project bulls from the third set of kandang groups in 2009 (Figure 17).

Of the matings, around 58% were from within the 23 project kandang groups in 2008 and around 54% were from within the 36 project groups in 2009.

The participation of surrounding non-group farmers (satellites) in using the project bull was greater than expected². In 2008, 4 of the 23 groups recorded greater participation from satellite farmers than group farmers, with a range of 0 to 82% matings. In 2009, 12 of the 36 groups recorded greater satellite use of the project bull, with a range of 0 to 75% matings.

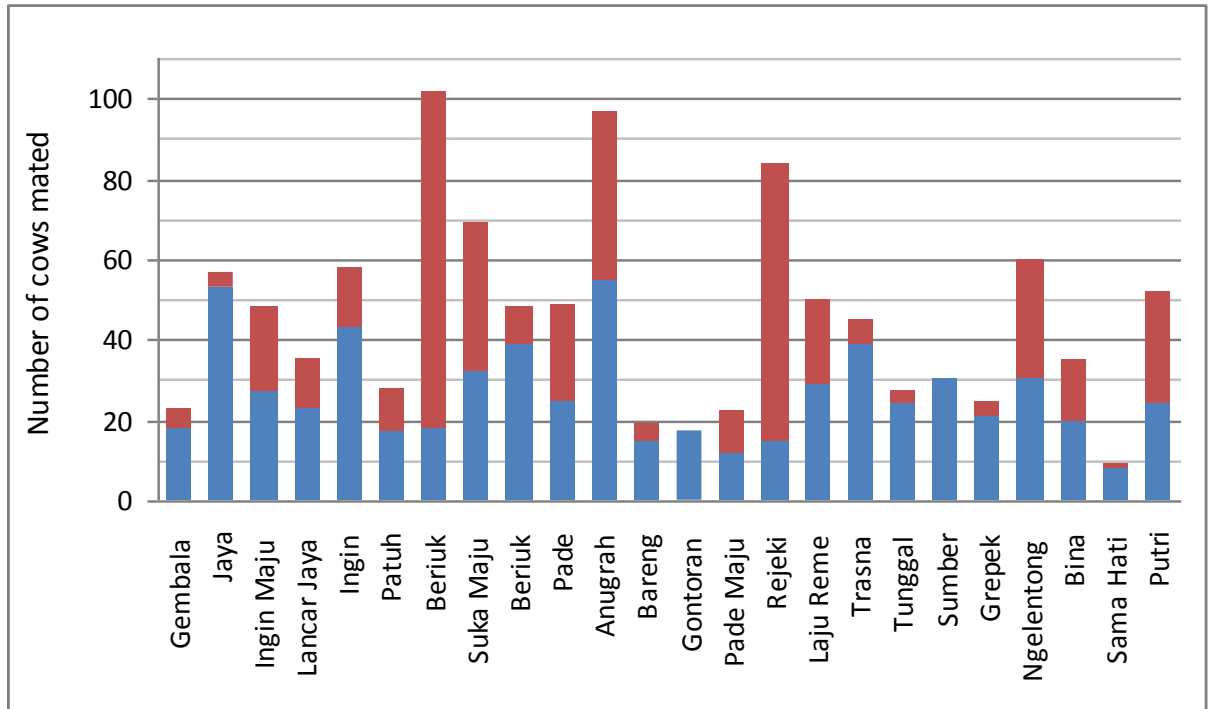


Figure 14. Number of cows mated by project bulls in each of the first 24 kandangs (from the first group) in 2008. The blue bar indicates cows from within the kandang groups; the red bar indicates cows from satellite farmers.

² A number of satellite farmers now keep their own bull for mating their own cows or other people's cows, for a fee. This is decreasing the use of the project bull service.

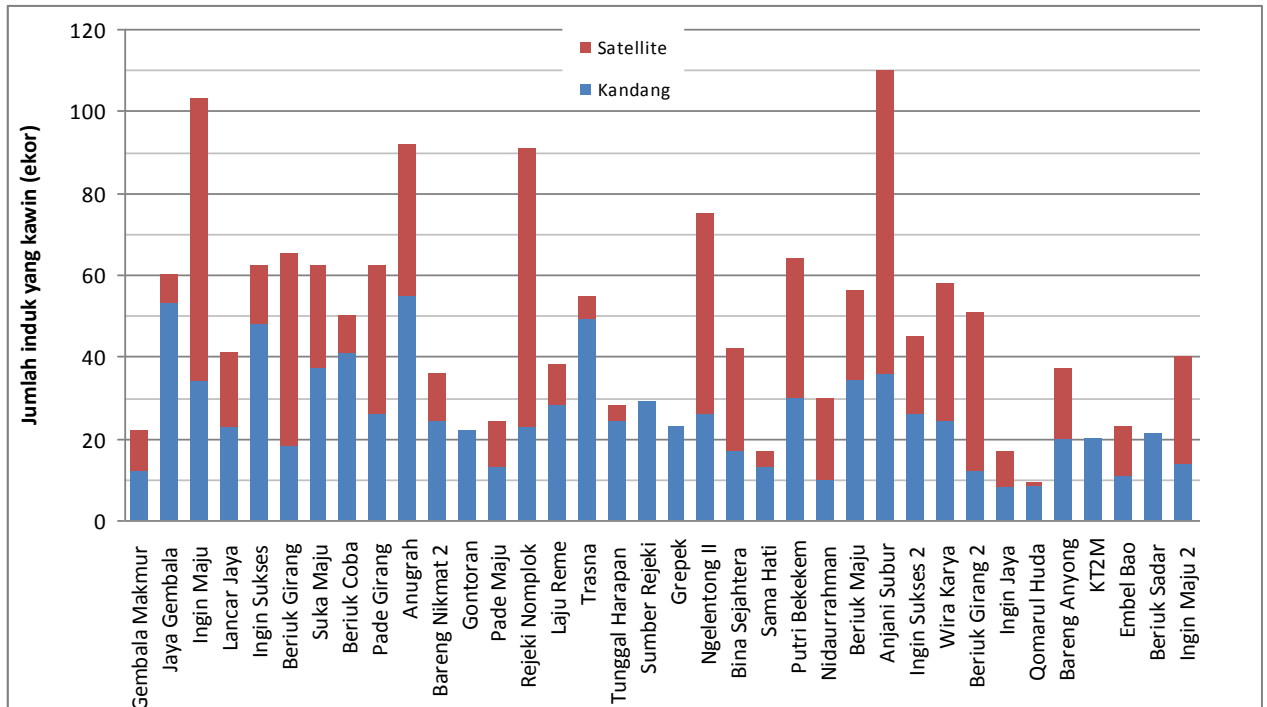


Figure 15. Number of cows mated by project bulls in each of the 36 kandangs in 2009. The blue bar indicates cows from within the kandang groups; the red bar indicates cows from satellite farmers.

A common belief amongst farmers (and institutions) prior to the project was that bulls are not able to mate with more than about 20 cows and/or that the bulls lose weight if they mate with many cows. For this reason, many farmers were reluctant to provide their own bulls for mating cows belonging to other farmers as their bulls generally were held for fattening purposes.

The project was able to demonstrate not only that quality bulls could mate with many more than 20 cows - some as many as 90 - but that they could also maintain weight during the mating period if fed properly. All bulls except three, gained or held weight during their mating period (Figure 16). Three that had small weight losses (Ingin Maju, Pade Maju and Laju Reme) suffered from a period of 3-day sickness.

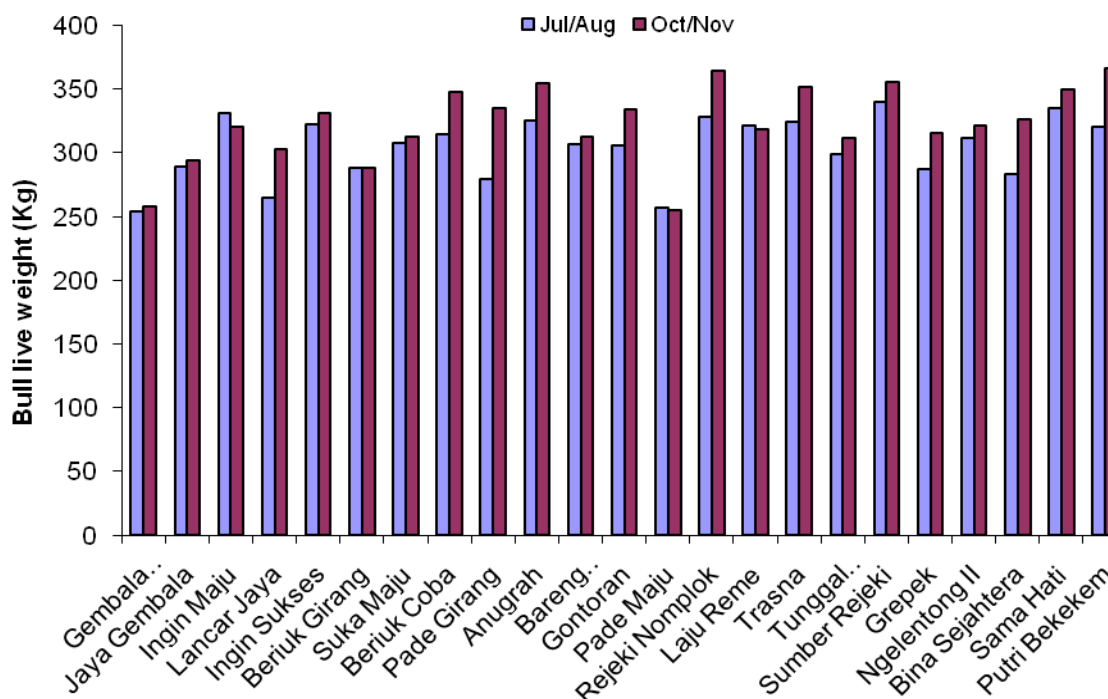


Figure 16. Bull liveweight over the mating period from July-August to October-November 2008.

Calving indicators

Indicators for calving success for the project are given in Table 8, and compared to Talib's³ (2003) figures for NTB and results from project AS2-2000-103 as a baseline, and to current Dinas recommendations as a comparison.

Table 8. Comparison of selected calving indicators from baseline data (Talib's 2003 and results from AS2-2000-103 project) and project results (to mid-2010) for the first and second set of kandang groups (n=23).

Indicator	Baseline data	Project average and range	Regional government target
Calving rate (%)	52 ¹	86.7 (57-100)	85
Calf mortality (%)	15 ¹	6.2 (0-14)	10
Birth weight (kg)	12.7 ¹	16.0 (14-18)	n/a
Weaning weight (kg) 6-7 months	70 ²	90.2 (67-117)	n/a
Daily weight gain between birth & weaning (kg/day)	0.25 ²	0.35	n/a
Calving interval	16 months ²	12.4 months	14 months

¹ Talib (2003); ² ACIAR Project AS2-2000-103

³ Talib's data is based on national and regional statistics, research data and information from government and university officers and regional farming groups.

It is clear from these figures that uptake of project practices has resulted in significant increases in productivity and calf health. In addition, project activities have met or exceeded existing regional government targets.

Birth weights from the 2007 and 2008 kandangs ranged from 14.0 to 18.2kg with an average of 16.0kg.

Improved nutrition and hygiene also resulted in increased weaning weights. These ranged from 66.8 to 117.4kg with an average of 90.9kg. Female weaners averaged 88.6kg while the male average was 91.7kg. Some of the variation between kandangs can be attributed to differences in the age of animals at weaning (not all farmers practiced early weaning), but also to quality and quantity of feed.

The gain from birth to weaning averaged 74.9kg over a period of 6-8 months. This equates to a daily weight gain of approximately 0.35kg/animal. Talib’s NTB average liveweight gain from birth was around 57kg in 8 months, or a daily gain of approximately 0.25kg/animal. In essence, these figures suggest that healthy, weaned calves that are preferentially fed high quality forage are able to reach reasonable slaughter weights (around 250kg) sooner than those without these management practices.

The major period for calving was May to August in 2009 (Figure 17) and May to July in 2010 (Figure 18). The shift expected by the project team to a calving period of March to June did not eventuate. While the project team reasoned that March to June calving would coincide with high quality and quantity of feed (and possibly increase re-conception rates), farmers considered the knowledge of how to manage and preferentially feed new calves as more relevant to their farming activities. In addition, the project team acknowledged that a shift to earlier weaning is likely to take longer than two years.

Most calf mortalities occurred from June to September⁴. Preliminary analyses suggest that of the deaths with obvious cause, around a quarter (9 of 38) were the result of diarrhoea or scours, likely resulting from poor kandang hygiene in individual kandangs. A detailed veterinary analysis of the causes of calf mortality across the year is the subject of a project extension, beginning in July 2010.

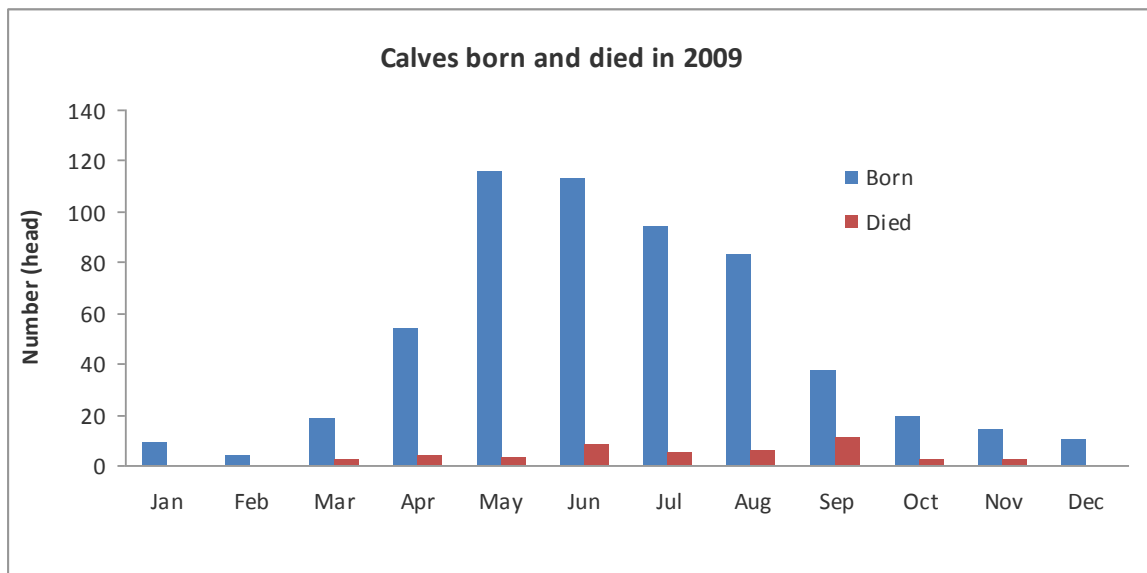


Figure 17. Distribution of calving and calf mortality during 2009, using data from first 23 kandangs.

⁴ This may be because more calves are borne during this period.

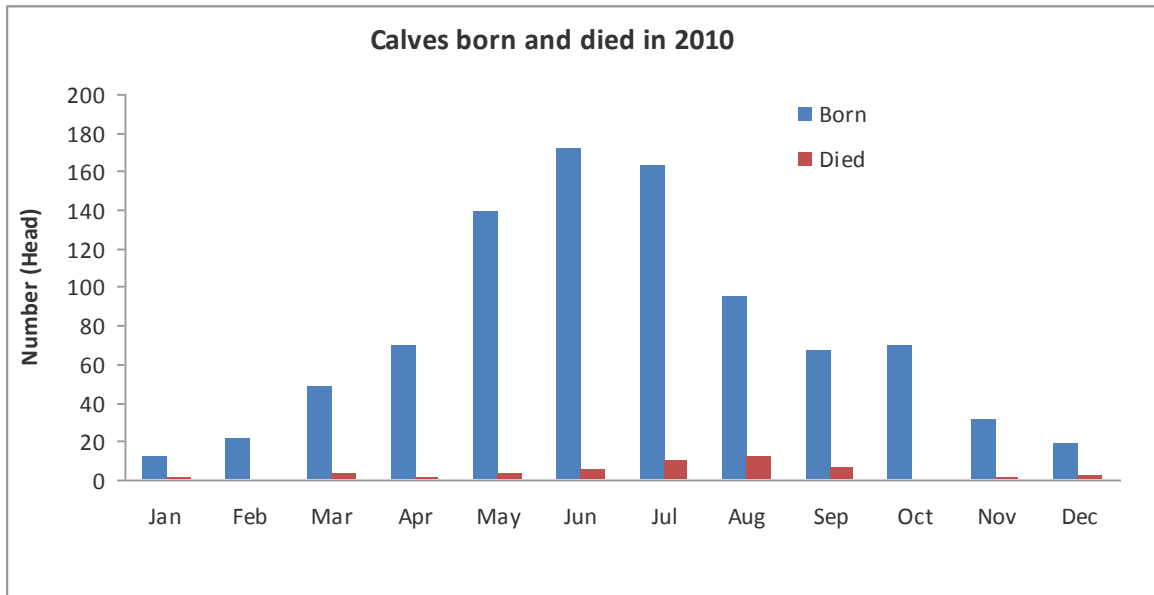


Figure 18. Distribution of calving and calf mortality during 2010, using data from all 36 kandangs.

Herd dynamics and cattle sales

Figure 15 is a summary of the movement of animals in and out of the first 23 kandangs over the period August 2008 to October 2009 and the period October 2009 to November 2010 (refer to Appendix 6 for details from each kandang).

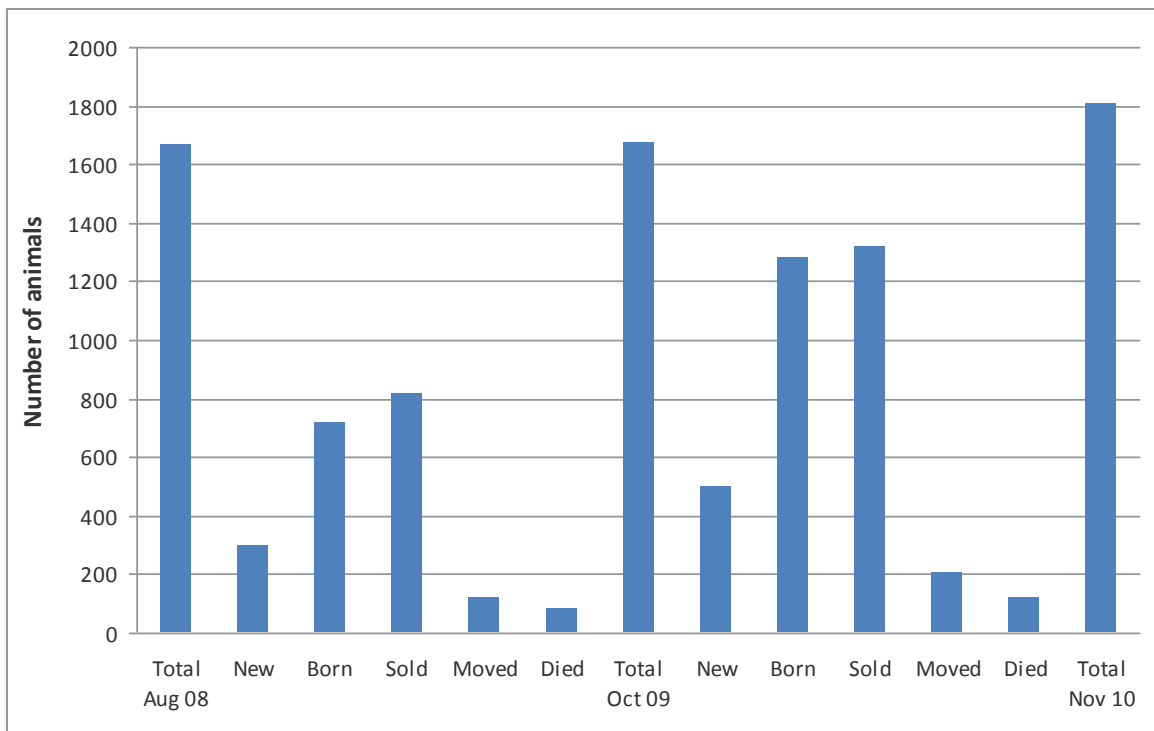


Figure 19. Population dynamics of first 23 kandangs from August 2008 to October 2009 and from October 2009 to November 2010.

In the first period (August 2008 to October 2009) 297 animals came in to the kandangs (either purchased or transferred from elsewhere), 78 animals died, 117 were transferred

out of the kandangs, 717 were born and 815 were sold. The total number of animals at the beginning (1671) and end (1675) of the period was almost the same.

In the second period (October 2009 to November 2010), 494 animals were transferred into the kandang, 115 were transferred out, 115 died, 1281 were born and 1319 were sold. The total number at the end of the period (1808) was an 8% increase on the number at the beginning of the period (1675)⁵.

Across these two periods, it can be noted that births and sales have increased significantly in the second period (78% and 62% increase on figures from the first period, respectively) although the number of animals in the herd has remained relatively constant.

Due to limited capacity to retain additional animals, these data suggest that farmers are realising their objective of increasing reproductive potential and converting this to greater throughput and increased sales.

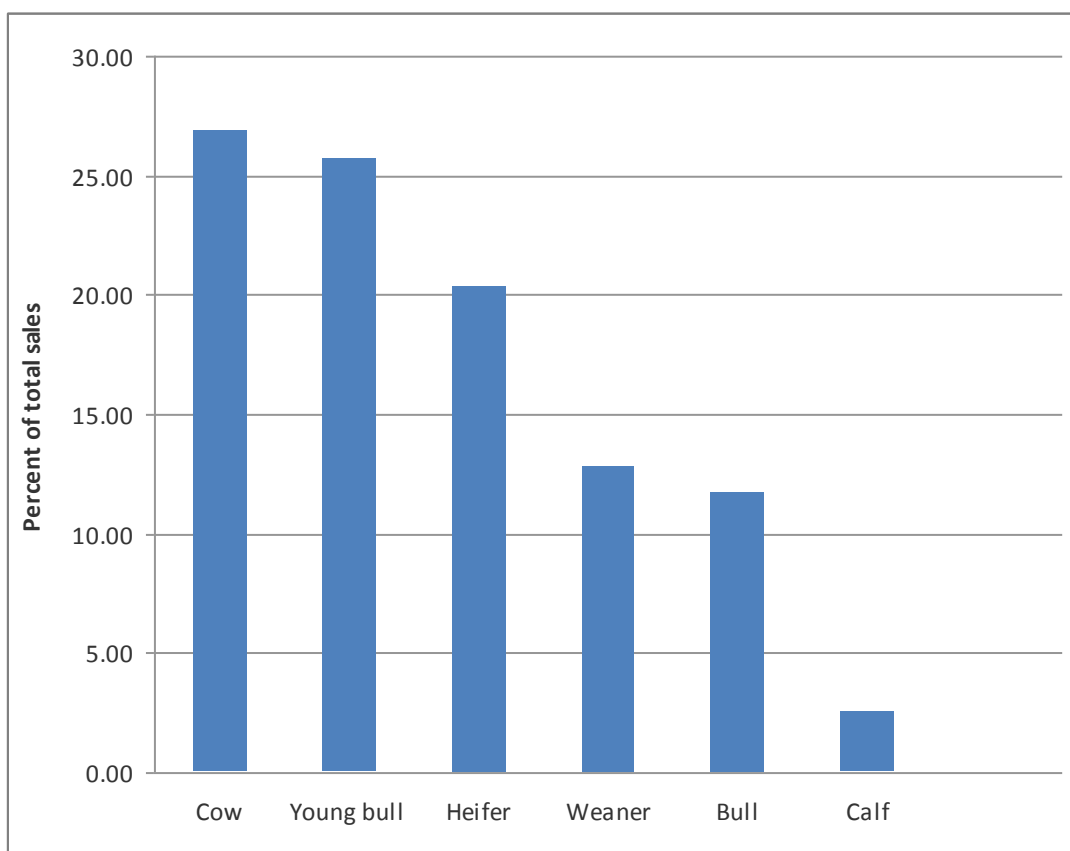


Figure 20. Percentage of cattle sold across cattle categories in the 36 kandang groups in October 2009. Note that bulls and cows are older than 24 months; young bulls and heifers are between 12 and 24 months; weaners are between 6 and 12 months; and calves are younger than 6 months.

Figure 20 shows that cows and young bulls comprise over half of total sales (53%). Heifers contribute around 20% of sales. It is assumed that farmers are able to sell animals earlier (eg heifers rather than cows) because increased weight gains associated with better calf health and preferential feeding result in competitive prices at market.

The timing of these sales and the reasons behind them are the subject of a component of the project extension and will be reported on in mid-2011.

⁵ It should be noted that the second period was slightly longer than the first period.

It is expected that sales will continue to increase as project practices – particularly improved forage, preferential feeding and improved hygiene – are adopted.

This is evidenced in the sales figures for the period January to July 2010. The first, second and third kandang groups had a similar number of cows (363, 343 and 319, respectively) but sold 145, 109 and 65 animals during this period. So with 18 more months of exposure to the project, the first group was able to double the cattle sales of the third group.

Discussion

Previous ACIAR studies have indicated that farmers in this region perceive that one of their greatest impediments to production is the lack of quality bulls. Without access to a bull, there is little likelihood of reducing inter-calving intervals, increasing calving rates or of realising the regional government's vision of increasing NTB's breeding herd to levels that could service Indonesia's growing demand for beef.

Introduction of a bull – in a participatory manner, into a collective system that can support communal management – has been highly productive and socially successful. From this entry point, farmers have been able to test and adopt other animal management practices, such as early weaning.

Adoption of forage management practices (introduction of new forages and better management and use of existing resources) has been more challenging due largely to high levels of landlessness. Despite this, there has been considerable uptake of these practices, with farmers using any available land – particularly communal land and shared bunds – to grow new forage resources and to use them in preferential feeding for pregnant and lactating cows and newly weaned calves.

While not formally a project practice, the co-contribution of funding and provision of advice on kandang renovation has resulted in major improvements in hygiene and drainage, as well as group cohesion.

Adoption of project practices has resulted in significant increases in important productivity indicators. Calving rate, birth weight and weaning weight were all higher than regional figures, while calf mortality and inter-calving interval decreased to become less than regional government targets.

In essence, the project's stated aim of 'one cow, one calf, one year' was almost realised in a period of around 2.5 years. On average, the calving rate is around 87% (with 95% calf survival) and the calving interval is just over 12 months.

Increased productivity creates a challenge in a resource limited system. There is limited space in existing kandangs to house new animals and little additional land to grow forages to feed them. Herd dynamics data suggest that while herd size remains relatively stable, births and sales have increased. Farmers are able to sell animals at a younger age because the weight gain between birth and weaning has increased – hence a market-ready animal requires fewer inputs for the same financial outcome. Sales data show that it is predominantly cows, young bulls and heifers being sold.

In this way, farmers are realising their objective of increasing reproductive potential and converting this to greater throughput and increased sales without overt strain on forage or housing resources.

This poses a challenge for regional government initiatives such as increasing NTB's breeding herd. Unless more land becomes available for forage production, herd numbers are unlikely to increase, even though increased throughput is benefiting farmers.

7.2 Understanding adoption

Summary

This section examines how farming households make decisions about whether to adopt project practices or not, based on an understanding of available and accessible physical, economic and social resources.

This project occurred in the context of resource limitations. A key reason for the success of the project has been its ability to address some of these limitations (eg provision of a bull to project groups).

Key institutions or activities for the spread of information were the mosque, family networks, use of the bull service and through collective activities such as forage collection. Satellite farmers generally received less information and were less certain of the value of project practices and how to implement them.

The project has played a key role in facilitating improved governance structures, and broader mandate of operation for kandang groups (eg group decision making). It remains to be seen if these are sustainable beyond the project (without facilitation by the OGTs).

7.2.1 Research framework

Resources available to the farmer determine the farmer's viable options or choices. Resources may include land area and cattle ownership, as well as non-material resources such as labour and access to markets and information. Only options perceived by the farmer to be viable may be considered as genuine options - non-perceived options (those seen by others but not by the farmer) are effectively not viable.

In choosing between viable options, there is an assumption that the farmer does not commit to adoption in the absence of a social and cultural context (Koppel 1985). Rather, the selection criteria for decision making are based on the farmer's economic priorities (maximisation of income or maintaining the household's subsistence) as well as his or her evaluation of the social and economic risks involved (see Figure 5).

This research framework guided analysis of household perceptions and decisions relating to uptake and adaptation of practices promoted by the project. A challenge in this analysis has been the ambiguity regarding what constitutes adoption, and how to accurately identify when it has occurred.

Defining adoption

The project team devised a working definition of adoption relevant to practices encouraged as part of the project. Adoption is considered to have occurred when:

- 1) A household is using one or more of the project practices
- 2) There has been a shift in the livelihood strategy of the household, ie cattle production has increased in importance compared to other parts of the farming system

To have 'adopted' in this study, households had to actively engage in at least one practice introduced as part of the project. These practices were defined as:

- Controlled mating
- Early weaning

- Preferential or supplementary feeding
- Forage production and use⁶

However, adopting practices is an insufficient measure for the purpose of the study. For adoption to be considered to have occurred there must also be qualitative change in the farming system. For example, the presence of an introduced forage species on a property would not in itself signify adoption without an accompanying change in how forage is managed and used.

‘Adoption’ is not a single decision but a series of decisions, actions, evaluations and adjustments that evolve and respond to changing information and experiences (Koppel 1985, Feder et al 1985). By identifying qualitative shifts in allocation of activities within the farming system, the project team attempted to distinguish between trialling of practices (which may be temporary) and adoption where there is a decided, longer-term shift in activities. The decision involves a re-allocation of the household’s resources and economic portfolio – both to adopt a new practice and in response to the outcomes and results of adoption.

If more emphasis – ie more resources, more inputs – is placed on cattle production, it follows that cattle production is not merely considered as an addition to the economic portfolio but a more central component of it. In this case an accompanying shift from subsistence to a higher level of market integration is expected. Such a shift may also include farmers who previously had no cattle at all but are encouraged by seeing the success of participating project farmers to plant their own forages or buy or share cattle to add cattle production to their farming system for income generation.

As follow-on effects, farmers may also decide to grow forages to sell, or to provide feed (on a share farm basis) to other farmers for raising cattle, or to provide planting material (cuttings and/or seed) to sell to other farmers. Such small business opportunities have been taken up in Thailand, Cambodia and Vietnam and will likely occur in Indonesia if scale out succeeds and encourages a market for planting material.

The project team looked for shifts in livelihood strategies that would identify or indicate adoption. New practices may change the resource base for the household, which in turn, would lead to shifts in viable options. The household may then decide to change its livelihood strategy, eg from subsistence-oriented to market-oriented. It is through these shifts that we can detect whether adoption is occurring. Obviously, measuring these shifts will be difficult. As an indicator, the importance of cattle vis-à-vis other elements of the farming system (eg crops, poultry) is used.

7.2.2 Kandang groups

In a collective kandang system individual decisions are mediated to some extent by the expectations and norms of the group. Before looking at the case studies in detail the dynamics and decisions relating to the kandang group will be discussed, as background to household decision making.

The practice of housing cattle collectively began in the mid 1980s, primarily as a mechanism to improve security after widespread problems of cattle theft. In this way, the responsibility of watching cattle overnight was spread across the kandang membership, and the risk of cattle theft was lowered. However, time needed to be set aside for

⁶ Improved sanitation is not listed here as it is mainly relevant to the kandang groups, rather than individual farmers.

watching over cattle, taking cattle out to graze each day and returning them to the kandang at night.

At the start of the project, the main function for some groups was still security, with limited governance structures or collaboration between farmers. For example some of the kandang groups had no formal group leadership prior to the project. A point of contact was needed for the project so OGTs worked with the group to initiate the election of this position.⁷

The size and structure of kandangs vary. The land on which kandang groups operate is either owned by the group (or one of its members); rented or designated by the government. Rental or payment systems also vary from group to group, as do conditions and obligations for membership. Kandangs established by the government can usually be identified by cement flooring and better potential for sanitation and drainage⁸ while community initiated kandangs generally have dirt flooring and face significant sanitation issues (refer to Section 7.1.1).

To be a member of a kandang group, households generally must:

- Live close enough to the kandangs to make membership worthwhile (ie if the distance from house to kandang is too far, it becomes too time consuming or difficult to house cattle there);
- Look after cattle (their own or someone else's)
- Have time to contribute to night watch duties
- Pay rent to the group (this varies between groups and was either per pen or per animal).

In order to take on new members, kandangs must also have available space (eg spare pens).

By agreeing to be involved with the project, kandang groups were (in essence) collectively deciding to trial the practices suggested by the project. It was a condition of the group's involvement that they would trial controlled mating as a minimum. All groups were provided with a bull and a negotiated sum of money to help fund infrastructure improvements.

Participation in the project also provided the kandangs with regular support of a dedicated OGT member, who provided information, support and advice and coordinated activities such as field visits to other kandangs and cattle weighing days.

Consensus was reached in all groups on who would be the 'bull keeper' and how income generated by the mating service would be distributed between members and the keeper. Negotiations were facilitated by OGTs and agreed arrangements varied from group to group.

Farmers who were not members of the kandang groups were able to use the bull service for a fee – something that was very popular given the shortage of quality bulls for mating. In analysing adoption the PST chose to contrast the experience of kandang group members and non-members. This provided the opportunity to examine how the project practices are perceived and adopted without the support of the OGT and outside the group environment.

⁷ Group leaders are elected by the members. OGTs felt there was rarely any competition for the job – particularly as there is little additional benefit for the group leader.

⁸ While there are better sanitation systems in government-established kandangs, there are problems associated with storage and management linked to a lack of training for group members on how to take advantage of this.

In summary, there were significant (material and immaterial) benefits and incentives for those groups who agreed to be involved with the project, even before project practices were implemented. Reasons for not participating at the group level were not the focus of this research. However, OGTs suggested some groups that were approached declined to participate as they were too busy.

7.2.3 Household decision making

This section provides an overview of the household decision making context, in terms of a household's physical, economic and social resources, how they are perceived and prioritised by those interviewed, as well as risk, information transfer and how these factors influence adoption.

It is based on four case studies comprising 20 interviews each. In presenting findings from these semi-structured interviews, there is a focus on recurring themes within and across the case studies that help identify broader lessons or highlight significant points of interest.

Land and cow ownership

The average area of land that households had access to (including land owned and/or rented) was highest for Labulia (0.47ha) and lowest in Batunyala (0.17ha). This is much lower than the household sample in the sister project in South Sulawesi, where farmers interviewed had more land per household on average and fewer landless households (van Wensveen and Rachman 2010). The average cattle ownership per household was 2-3 animals for all case studies.

For those farmers with access to land, all were producing one rice crop plus one additional crop per year. Many households had replaced mungbean and soybean crops with tobacco, which was viewed as more profitable, although this was less common in the Labulia case study.

Many households with smaller areas of land were unable to meet family needs through farming alone. Diversified income portfolios were common, with on-farm activities such as poultry, goats and cattle complemented through farm labour or small business enterprise (eg cidomo⁹ driver, handicraft, construction etc).

[He] works as a farmer (agriculture and cattle farming). In his spare time, he also works as a part time motorcycle taxi driver (ojek). He sells 70% of his rice production to cover his daily expenses and saves the rest to cover his rice consumption for six months period. He uses his income from ojek as additional cash to meet his daily expenses and also to give pocket money to his children. He considers cattle as his saving and only sells his cattle to meet urgent and costly expenses.

Farmer 74, Satellite, Batunyala¹⁰

Diversified income was important to meet different household needs. The role of cattle and other livestock in terms of income was differentiated and very different to the sister project in Sulawesi. Many of the farmers interviewed distinguished between:

- Calf production – for annual income or large expenses

⁹ A small horse drawn carriage often used for passenger transport.

¹⁰ Quotes are taken directly from Interviewers' summaries. For more information on data generation, see the 'methodology' section of the report.

- Fattening of bulls – six monthly income
- Poultry and goats – daily expenses

If he has adequate capital, he plans to scale up his husbandry activity, including cattle, goat and poultry. He expects to receive annual income from cattle breeding, monthly income from cattle fattening and goats, and daily income from poultry. In addition, he also plans to buy land for forage production for his cattle.

Farmer 49, Satellite, Kelebuh

This level of distinction, particularly between calf production and bull fattening suggests a higher level of market interaction than in the Sulawesi project. This is likely to be linked to land and forage constraints that limit the number of cattle each farmer can keep (ie cattle sold for money rather than kept for saving).

Income from cattle was often prioritised for education and other significant expenditure such as house construction, sending family members to Malaysia as migrant workers or Hajj travel.

There is a strong cultural perception that to be a successful or 'good' farmer, one must have both cattle and rice. This is typified by the Sasak saying '*ngaro ngarit*' which means feeding cattle and cropping are complementary and together provide a good income. While this was specifically mentioned in Labulia, the complementary nature of cattle and rice farming and the equal importance of both activities were clear throughout all case studies.

Perceptions of risk and income varied between interviewees and influenced household plans and aspirations relating to reinvestment of income. For many households, investment in land was seen as providing concrete or tangible outcomes. For others, breeding or fattening cattle provided good income for little (physical or economic) investment.

Buying land is considered as a tangible form of his achievements. However, he also wants to develop his cattle farming activity because the profitability is high and will enable him to buy assets, including to expand his farm land.

Farmer 1, Group Member, Labulia

If he has surplus in his income, he would like to buy or rent farm land for rice field because for him, renting or buying land is a form of saving and also is a tangible form of his efforts. By having rice field, he would be able to meet his daily consumptions. He prefers to have land than to have cattle or other form of activities. However, he still likes to raise cattle because income from cattle allows him to fulfil his needs and also can be reinvested to buy land.

Farmer 14, Group Member, Labulia

He allocates some portions of the income to buy more cattle and give it to other farmer to raise under the profit sharing arrangement. He prefers to invest in cattle because the maintenance is easy and the market is clear. However, he is also planning to allocate his income to buy or rent land for farming.

Farmer 54, Satellite, Kelebuh

Cattle serves as saving for him – he prefers to invest his wealth in cattle than to save the money in bank or to buy farm land (rice field) because the return is faster than agriculture (rice farming). If he has cash of 4 million rupiah, he can buy a calf which

he can sell in months at higher price – while with the same amount of money he cannot afford to buy a rice field.

Farmer 65, Satellite, Batunyala

Cattle management strategies

While some farmers still take cattle out to graze, for many this is complemented or combined with cut and carry forage practices. The shift from extensive grazing to intensive production in this system appears somewhat easier than in other regions (eg South Sulawesi; see van Wensveen and Rachman 2010), with much infrastructure already established, albeit in sometimes less than ideal conditions.

Bull availability was seen as a key constraint to cattle production. Prior to the project, many farmers left cows in communal areas in the hope of opportunistic mating with an available bull, took cows to neighbouring villages to find a bull for mating, or used artificial insemination. The provision of a bull to participating farmer groups ameliorated this resource constraint. Controlled mating with a quality bull has been the most widely adopted project practice – both among kandang group members and satellite farmers.

In some instances, satellite farmers were prepared to travel two kilometres to use the bull service. The time and cost involved was not considered onerous because they felt the results were good. Also, the practice was seen as one of the easiest to implement.

Even though the distance between his place and the group pen is quite far, it is not a problem for him to use the bull because he is satisfied with the quality of the produced calf.

Farmer 4, Satellite, Labulia

[He] did not have to go far to find quality bull or call artificial insemination officer, which he considered risky and also difficult.

Farmer 10, Satellite, Labulia

However, it is questionable to what extent satellite farmers understand the full extent of the controlled mating practice, which aims to preserve good genetics, but also to time calving to availability of quality food. The first of these points seemed well understood by satellite farmers, but did not guarantee continued use of the service, with one farmer reverting to artificial insemination when the project bull had been sold.

However, now he is not able to use the bull anymore because the group has already sold their bull. This situation forces him to use the artificial insemination practice.

Farmer 4, Satellite, Labulia

Similar to the sister project in Sulawesi, many farmers in Lombok were concerned that using a bull for mating would be detrimental to the bull's health and weight, thereby reducing its value. By providing the group with a bull and monitoring its weight and number of mating events, there was clear demonstration that this was not the case. In this way, concerns were allayed without requiring any farmers to directly risk their own livelihood or assets. As a consequence, there is anecdotal evidence that farmers outside the project are now keeping bulls for mating purposes.

Compared to controlled mating, in which provision of a bull seemed to facilitate adoption, adoption of forage related practices was less straightforward. Although resources in the form of seeds and cuttings were provided, the resource provision did not translate into adoption in the same way as for controlled mating.

There is often no established entitlement over forage resources, with households free to take forages from private land, as well as road sides and river beds unless these areas had been 'claimed' by another farmer. OGTs felt this was often a disincentive for farmers who may otherwise have put more effort and resources into the activity.

For the feed supply, she is using the natural grasses that grow on the dikes between the rice fields, therefore farmers have to share the resources with each other, unless ... the grasses that have been claimed by other farmers.

Farmer 6, Satellite, Labulia

It was common for farmer group members to have small areas of forage (either existing or new varieties) planted on bunds between rice fields or in front yards. One farmer in Kelebu had substituted crop land for forages:

..now he allocates most of his land for forages (turi) since income from forages (cattle) is considered to be more profitable than from rice or dry season crops

Farmer 49, Group Member, Kelebu

This activity was not discussed in any other interview, however a number of farmers aspired to buy land to grow forage in addition to other agricultural activities.

Farmers in Labulia did not perceive availability of forage as a constraint to the same extent as farmers in the other case studies. This kandang group is in a wetter area, and had existing knowledge related to forage use, which has been strengthened by the project.¹¹

The adopted cattle farming practices have not changed for years. The only difference now is the availability of quality bull by ACIAR project during the mating season which is very useful for the farmer. Other technology has been practiced since long time ago - he is already using tree legumes and forages as cattle materials, but he just recently learned about the right composition of the resources to become proper feed materials.

Farmer 9, Group Member, Labulia

This perception in Labulia also influenced the information that was passed on to satellite farmers, with many only receiving information about the bull service from the group at the time of mating.

Knowledge and information

All case studies except Kelebu highlighted clear differences between farmer group members and satellite farmers in terms of how the project practices were perceived, and this was linked to how information was provided. The Kelebu case study focused on the narratives and information exchange between farmer groups involved with the project.

In Ubung and Labulia, limited provision of information was a key constraint to satellite farmers adopting practices other than controlled mating.¹² Farmer group members

¹¹ This may also be the case for Ubung. However it is difficult to confidently deduce from the data available ie forage is not mentioned as a constraint, but it is not clear if this is because there are many resources available, or if forage was not mentioned in the narratives, which in general contained less detail than in the other case studies.)

¹² It must be made noted that it was not the intention of the project (nor was the role of the OGTs) to transfer information and support adoption outside of the kandang groups. This discussion is presented only to look at ways to increase impact and design future work.

interviewed in Ubung shared information about controlled mating and new forage as a minimum. However almost all the satellite farmers interviewed had only implemented controlled mating and received 'brief information about the project technology' and/or 'did not yet clearly understand the technology'¹³ (Figure 21a).

Similarly, in Labulia, some satellite farmers only received the full information package at the time of the interview. Based on this brief knowledge, they judged the resources to be available locally, and the technology simple enough that it could be adopted, if not for the absence of 'direct facilitation by the field officer'¹⁴.

Of the six satellite farmers in Labulia who adopted more than one practice, one lived close to the kandang and another was family of a farmer group member. Another had previously been a member of the Labulia case study farmer group, however had left over frustration with the lack of space and started his own farmer group nearby. This farmer and another member from his group show on this network as having adopted two and three practices each (nodes 10 and 12, Figure 21b).

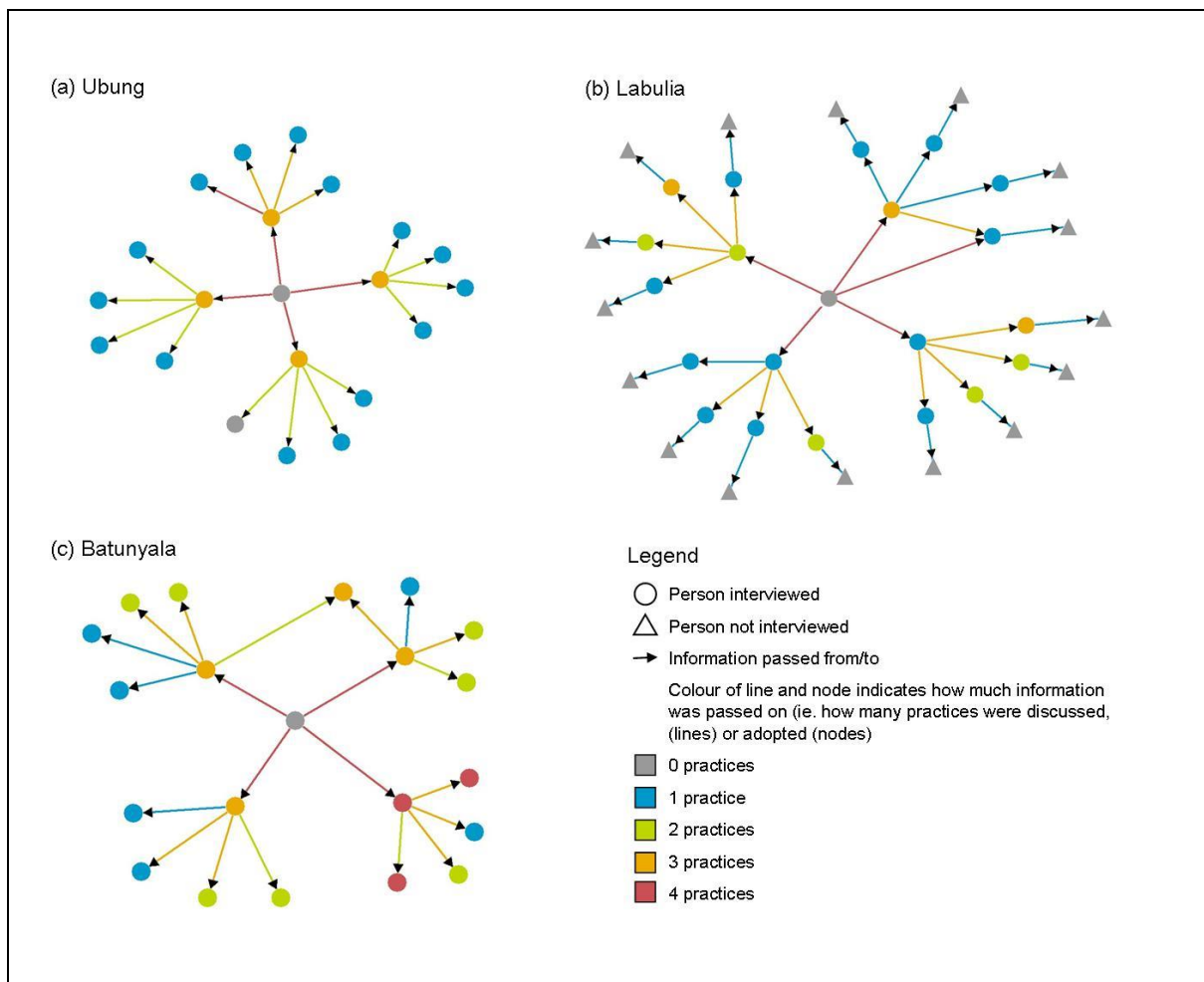


Figure 21. Comparison of information provision and adoption in a) Ubung, b) Labulia and c) Batunyala case studies. Centre nodes represent the OGTs; the 4 nodes closest to the centre are all members of a kandang group involved with the project; nodes further out are either satellite farmers (coloured based on number of practices) or non-adopters (grey).

¹³ One of these two statements occurs in every satellite farmer narrative.

¹⁴ Similarly, this statement was found in six of the 16 satellite farmer narratives.

In Batunyala, more than half of the satellite farmers interviewed adopted practices in addition to controlled mating (Figure 21c). The narratives of these farmers refer to repeated discussions between farmers (similar to those near the Labulia group) and seeing forage plots or quality calves that 'inspired' them to try other practices as well.

For the other satellite farmers in the Batunyala case study, most information was received, however current satisfaction with their farm production meant there was no incentive or interest in the other practices. Associated with this is that farmers felt if they were not members of the kandang group, they had no need to implement the other changes.

So far, he is only interested in the controlled mating technology and is not planning to adopt the other technology packages. He is satisfied with his current cattle farming practice and has no plan to change it.

Farmer 72, Satellite, Batunyala

He has mated his cow with the quality bull of the group and admitted that he is attracted by the existence of the bull. He has seen the demonstration plot of mulato and also received the seeds from [Kandang member] that he planted in his rice field dikes. However, so far he has no plan to adopt other technology packages. He is satisfied with the existing achievements from the current practice and is not planning to change the practice. He only plans to continue adopting the controlled mating practice by utilising the available quality bull to produce quality and healthy calf.

Farmer 76, Satellite, Batunyala

[He] is not interested to adopt other technology packages because he is not a member of the group that requires him to practice the entire technology package. Moreover, he only considers cattle as his saving and only concerns about how to maintain the good performance of his cattle, as long as he can meet this condition, he has no interest in other business.

Farmer 70, Satellite, Batunyala

Discussion

Biophysical constraints on available land mean adoption of practices that require land (eg forage production) can only occur to a certain extent, regardless of intent. The available resources in the farming system do not allow for a significant increase in the forage area cultivated without corresponding adjustments to the system (eg replacement of other crops, purchase of more land). Whether or not households chose to do this depends on how they perceive and prioritise the different activities in their livelihood portfolio and perceptions of risk.

A potential constraint for adoption of project practices was the lack of availability of a bull for mating. This was identified at the beginning of the project and accounted for in the project design. Importantly, rather than simply providing a bull, the project helped create agreed rules for bull service and income generation. This ensured the group had its own resources (and strong incentive) to continue to provide bull services without depending on the presence of the project.

The practices promoted by the project were built on existing knowledge and infrastructure – taking structures (ie kandangs) and knowledge (eg regarding forage) and further developing how these resources are perceived and used. This has made adoption of practices easier or more accessible for households in some cases.

For example, in South Sulawesi, where kandangs are less common and reserved for bull fattening, lack of infrastructure was a key constraint for farmers who would otherwise

adopt controlled mating and early weaning (van Wensveen and Rachman 2010). While it may seem obvious that practices building or developing existing resources or knowledge are more easily adopted, it is not always common for this to be taken into consideration in the design of interventions.

There were two key mechanisms for farmers to promote and discuss project practices. For project kandang groups, visits to more established project groups provided evidence of what could be achieved in a realistic (ie 'on farm') setting.

For those farmers who were not members of groups involved in the project, the presence of a quality bull for mating at a reasonable cost was crucial, attracting many farmers to the project kandang.

Satellite farmers bringing cows to be mated created an opportunity for group members to discuss the project further. In some cases, this helped to promote the project and the broader package of practices. In many cases the opportunity for dissemination of information outside the group was missed.

The extent of information provided by the bull keeper and other group members to those using bull services varied. In the future, provision of information by a combination of group members and experts (such as PPLs or OGTs) to those using this service could be a simple way to target support to interested farmers outside groups.

In reality, this is tempered by the intense nature of support that OGTs have provided farmer group members, as well as the sheer number of farmers within a group which makes the feasibility of supporting additional farmers doubtful.

Based on observations and discussions with the OGTs, the sustainability of project practices beyond the project is not certain – for either the kandang groups or the satellite farmers.

For the kandang groups, the OGTs and project more generally have played a crucial role in developing governance structures and supporting problem resolution while constantly providing advice regarding the implementation of project practices. It remains to be seen how successfully the groups continue (as a functioning group and in terms of adoption) without this support.

Similarly, it is reasonable to question how well the whole package or knowledge of project practices will persist outside of project kandang groups. Information provision to satellite farmers is already mixed, as is their interest to pursue practices further based on generally brief information.

7.3 Spreading information

Summary

Scaling out information from kandang groups to satellite farmers was not a priority for the project. Nevertheless, natural expansion of project ideas has occurred and this section looks at factors and activities influencing dissemination through farming communities.

There were 400-500 satellite farmers that took up some of the technology package and bull services (and controlled mating) were the entry point. Although bringing cows for mating provided a good opportunity for discussion, limited information was shared and subsequent adoption was minimal.

To achieve widespread geographical benefit and impact, replication seems more viable (or faster) than farmer to farmer interaction over longer distances. Suggested areas of focus include uptake of project principles by local livestock agencies and support for key community players in information transfer, particularly kandang group members and bull keepers, and support for improvements in livestock policy.

7.3.1 Information from satellite farmer survey

A key aim of this project has been scaling up of beneficial project practices through policy and government institutions. While scaling out of practices was not a particular aim¹⁵, there has been a natural expansion of information from farmers directly involved in the project to non-kandang group members in the vicinity, or 'satellite farmers'.

There were 400-500¹⁶ satellite farmers in communities surrounding the project kandang groups that took up some of the technology package introduced to the kandang groups.

According to a survey of 385 satellite farmers in November-December 2009, the profile of the satellite farmers was similar to that of the kandang groups farmers with respect to land ownership and size, farming system and livestock holding.

At least initially, all satellite farmers interviewed became involved with the project to use the services of the project bulls. The main reasons given for using the project bull services were that their village had no bull or they thought the project bull was better (Figure 22).

The average distance of these farmers from their nearest project kandang group was 1.01km, with 3km the greatest distance travelled by farmers to use the project bull.

¹⁵ It should be noted that the priority for OGTs was to support uptake of project practices by members of the project farmer groups, not by satellite farmers.

¹⁶ Participating kandang farmers did not take records of the number of satellite farmers, only the number of cows that were mated by project bulls. This figure is therefore an estimate only.

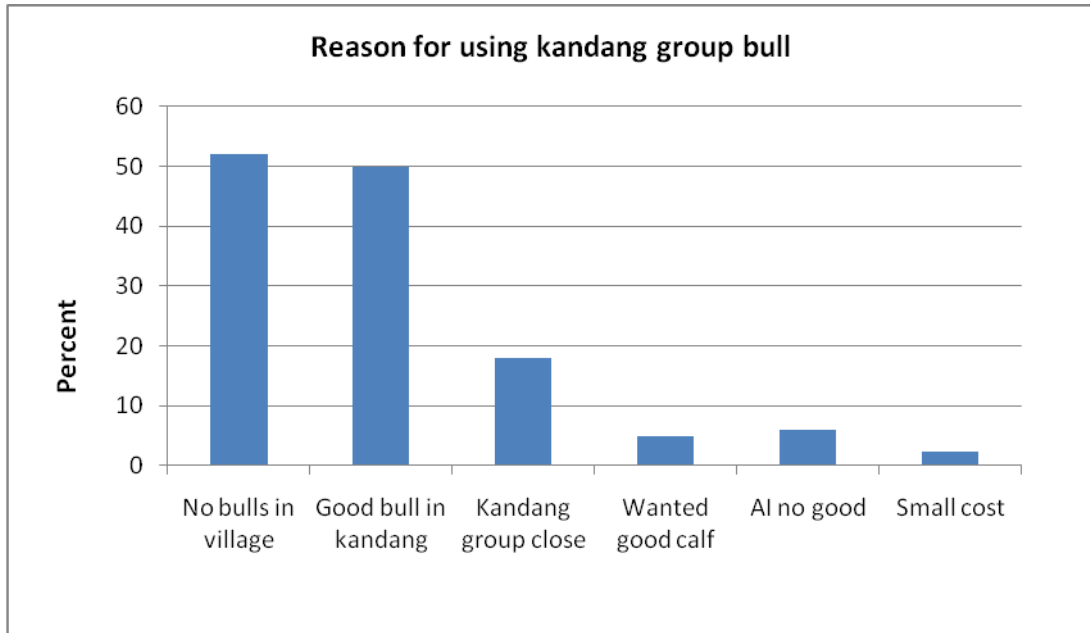


Figure 22. Reasons cited for satellite farmers using project kandang bull (percentage of farmers). Note that AI refers to artificial insemination.

Nearly half (47%) the satellites received information about the project bull services from kandang group members. Other sources include the local community outside the kandang group (8%), the kandang group leader (6%), the bull keeper (5%) and PPLs or OGTs (5%).

Other project activities the satellite farmers were aware of (but had not necessarily adopted) are summarised in Figure 23. Forage development was the project practice that satellite farmers were most aware of (75 of 385 satellites) and this is likely to be from direct observation of project initiated forage banks/demonstration plots. However, only 13 satellite farmers (3.4% of all satellites) actually started to develop forage on their own land.

Similarly, 23 satellite farmers were aware of early weaning, and only four (1%) were trialling or implementing with their own herd. Seventeen were aware of the benefits of tree legumes in the dry season and seven (1.8%) were feeding their cattle legumes at the time of interview.

Of the satellite farmers who used the bull service, the next most adopted practice was infrastructure improvement. However, only 17 farmers (4.4%) were actively pursuing this practice.

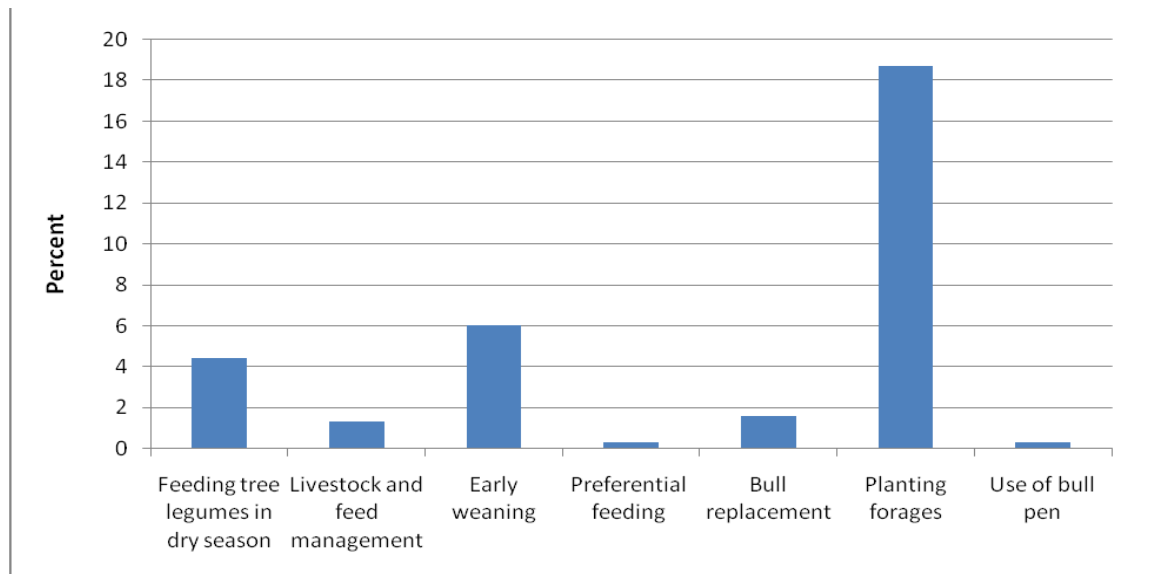


Figure 23. Information or awareness of satellite farmers about project activities other than bull services (percentage of farmers indicating knowledge).

7.3.2 Information from farmer narratives

Information and resource sharing between project kandang group members occurred in an organised or formalised manner through cross visits to different groups. This enabled project farmer group members to see and discuss results and activities with farmers who have experience in the practices.

In this way, claims of the OGTs regarding results were demonstrated and project practices gained legitimacy. Once new groups had talked about the project to groups that had been involved for a longer time, they were more receptive to the OGTs as information providers.

Kandang group members and non-member farmers shared information regarding bull services (as a minimum) in numerous contexts.

Provision of the bull service was an effective way of promoting the project to non-members. It provided a highly sought after resource and also an opportunity for members and non-members to talk in more detail about the project - albeit an opportunity that was not always followed.

The local Mosque was key to information sharing – both in terms of regular social interaction but in some cases also through announcements made by the Mosque to project group members.

Information sharing between farmers was also felt to be facilitated by their shared identity as farmers and the range of common tasks (ie working in a field or grass collection) and common knowledge of challenges in farming systems.

Discussion

The kandang system of Central Lombok lends itself well to the introduction of practices that can be collectively managed for mutual benefit. Regular communication and visible benefits resulted in trialling and adoption of additional practices (eg forage development, early weaning) by group members.

Although dissemination of project information from the kandang group to satellites was passive (ie there was little active promotion by kandang groups), Figure 23 (in Improving

Productivity) clearly shows a high level of engagement of satellite farmers in the use of the project bull.

According to the narratives, there was little information or context provided to satellite farmers about project practices and this deterred adoption for many farmers not in regular contact or communication with the kandang groups (eg through proximity or family connections). Other farmers did not adopt because they were satisfied with their current system, were waiting for proof of benefit or were resource constrained (see Appendix 3 for additional discussion of constraints to scale out and subsequent adoption).

For satellite farmers who did adopt, repeated discussions and direct observation of benefits were key catalysts.

According to the satellite survey, the average distance that a satellite farmer would travel for bull services – ie to address their most pressing production constraint - was 1km. In retrospect, the model for scaling out information is one that seems to be based on saturation within a limited area. The project influence is felt within a 'halo' of around 1km from the group, but rarely further without family or strong inter-group connections.

As such, the dissemination model can be seen as a predominantly closed model that requires replication rather than natural expansion between farmers to achieve widespread geographical benefits and impact.

For this it is necessary to embed the project approach into local or regional livestock agencies, for uptake and ownership by village level extension or livestock officers. Progress in this area is discussed in Section 7.5.

If scaling out had been an objective of the project, these data suggest that key actors in the dissemination process would be kandang group members, bull keepers (and experts such as OGTs or PPLs). If the opportunity for expanding project information is to be realised, then these key figures should be supported - by information, training and possibly incentives.

7.4 Measuring impact

Summary

This section looks at how adoption affects productivity and in turn, farmer livelihoods. Using a longer term dataset (4.5 years from the start of the project) from the precursor project, it was possible to identify significant impacts beyond the usual project length and to focus on changes since the end of the project influence (1.5 years after project close).

Analysis supported claims that implementation of project practices helped to improve household livelihoods through improved cattle condition increasing the value/price received for cattle, improved availability of forage and associated labour savings and freed labour invested into other income generating activities.

These data reflect impacts felt by farmers in dispersed, rather than collective systems, making direct comparisons and trajectories for this project's farmers difficult. However, this information does provide an indication of what impacts and changes can be expected by individual farmers adopting equivalent practices. A detailed analysis of the adoption – productivity – livelihoods chain will form the basis of the report for the 096 project extension.

Levels of analysis

There is an implicit assumption behind these projects that adoption of best bet practices will have a positive impact on productivity, which in turn will have a positive impact on livelihoods (Figure 4).

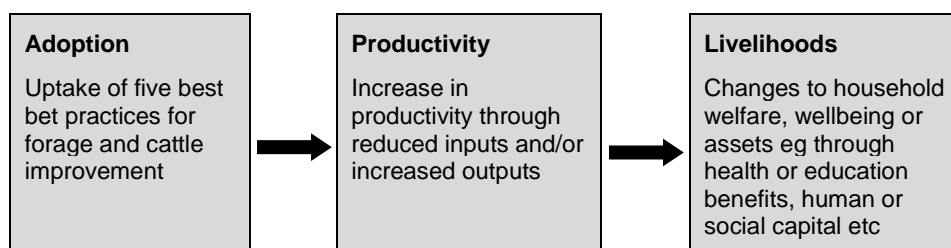


Figure 4. Assumed impact chain and aspirational targets.

To test this assumption, two levels of analysis are needed:

1. Impact of adoption on productivity
How have on-farm conditions changed as a result of adopting one or more of the project practices eg cattle condition, availability and security of feed supplies, flow on impacts in terms of crop production. Has there been an increase in net income? What other changes to the farming system (distribution of time use or labour) have occurred?
2. Impact of changed productivity on livelihoods
This acknowledges that an increase in income is not the 'end goal' or necessarily the only benefit from adoption. More important than income *per se*, is what increased income (or decreased labour investment) enables the household to do in addition to activities already performed. This could be investment into education, health care infrastructure or more extensive changes to the farming system.

7.4.1 005 project – analysis of impact

This section presents a summary of impacts from the previous 005 project activities in Lombok and South Sulawesi. The focus here is on how best bet practices have persisted or been adapted since the cessation of the 005 project, and what sort of impacts can be seen as a result of practice change *in the absence* of project staff and support.

While impacts during the life of the project are important, the real test of a project is the legacy it leaves after the incentives for people to participate are gone. Results presented and discussed here are a summary only. For further information, refer to Lisson and Corfield (2010) and Lisson et al (2008).

Adoption and adaptation of best bet practices

Of the 30 farmers interviewed, all were still using a combination of best bet¹⁷ practices identified in the original project (Figure 24). The highest rates of adoption or continued application were related to the introduction of new forage and better use of existing forages. There was a varied rate of adoption in terms of the cattle management strategies, which are more resource dependent. For example, adoption of controlled mating practices was limited by absence of a bull for mating, while early weaning and preferential feeding rely on adequate forage resources and available kandang for separation.¹⁸

Farmers have also continued to discuss and adapt original project recommendations. In many cases, farmers have chosen to adopt practices that were not identified in the original workshop as options for their farming system.¹⁹ In addition, seven out of nine farmers in Mertak are using maize and cassava crops to supplement cattle feed – reportedly due to an increase in confidence based on their experience with the project. There is also evidence this adaptation has been taken up by scale out farmers²⁰.

¹⁷ 'Best bet practices' refers to the tailored project practices that were agreed between farmers and researchers. Best bet farmers are those farmers implementing practices – the term does not refer to farmers with the best chance of success (due to resources, education etc).

¹⁸ Research into adoption as part of 061 suggests farmer perception of risk to calf and cow from early weaning deters adoption in some cases.

¹⁹ Expected based on experience in SPA / previous projects.

²⁰ Scale out farmers are farmers that are not formally part of the project that have voluntarily adopted practices, usually after engagement with project farmers or the project team. In this statement, scale out farmers have not only adopted practices, but adapted them to their own circumstances.

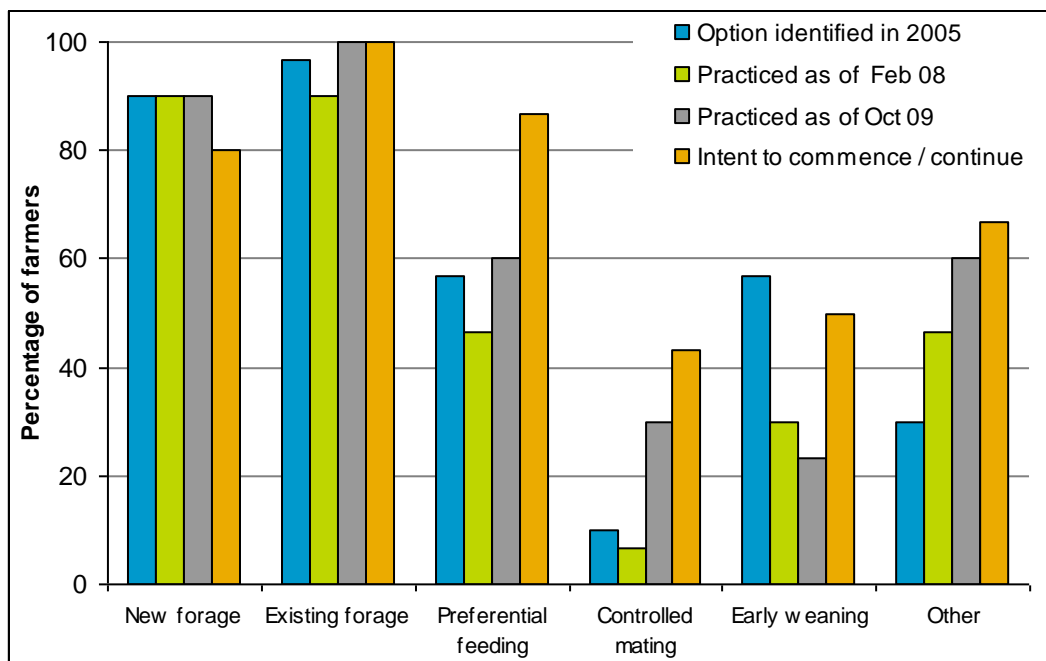


Figure 24. Percentage of farmers using identified practices. Each farmer may be practicing more than one activity associated with these categories. Practices in the ‘other’ category include housing cattle in kandangs and using water capture for stock.

Biophysical indicators of productivity

There were substantial gains in the use of forage banks in all sites, especially in upland areas. At the start of project, best bet farmers had on average less than 0.03ha of improved herbaceous forages. This increased to 0.11ha by February 08 and up to 0.4ha on average by October 09.

Tree legume establishment increased in upland areas, typically as a living fence for stock exclusion around the forage banks. Average on-farm *Gliricidia* row length increased from under 10m at the start of the project to over 120m by October 09.

Virtually all farmers felt that cattle growth rate and condition had improved as a result of the project (27 of 30 farmers confirmed improved growth rate in October 09, compared to 15 in February 08; 29 of 30 considered condition had improved in October 09, compared to 21 in February 08).

Changes in income

While the goal of the project was to increase beef production through improved nutrition, condition and reproduction, there was also an expectation of increases in cattle sale price and subsequent increases in household income.

It is important to note that increases in income are difficult to capture due to the large number of factors that influence income (eg fluctuating market prices, multiple sources of income etc). In the absence of detailed information on market prices and household income, the project team used farmers’ perception of changes to their income (as a result of the project) as a proxy indicator.

At the cessation of the 005 project, at least 30% of farmers interviewed had perceived an increase in their income as a result of the project (Figure 25). While this is significant in such a short period of time, due to the fluctuations mentioned above, the majority of farmers were uncertain about what had contributed to the perceived income increase.

When asked about perceived changes in income in the subsequent 20 months since the project finished, the responses were less certain. In Gowa, 12.5% of farmers were confident of an increase. In contrast all farmers in south Lombok were uncertain.

Levels of uncertainty regarding the source of income increases can be attributed to a range of factors such as:

- An increase in household assets (through an increase in the number of cattle kept and/or better cattle condition) may not yet have translated into increased income if no cattle have been sold in the time period;²¹
- A plateau of income increases since the cessation of the project/initial increases (ie fewer farmers have experienced further increase in income since 2009);
- Fluctuations or changes in cattle sale price make it difficult to compare income over time; and
- An increase in income from other sources such as increased crop yields or opportunities for non-farm work.

Farmers stated increased income was used or invested in the following areas:

- Farm improvements (4)
- Purchase of cattle (2)
- Forage development (2)
- Home improvement (1)
- Food (1)

²¹ *The sporadic, needs-based nature of cattle sales means cattle sales may not contribute anything to household income for a year or two if farmers don't need the money or if the age profile of his cattle is not conducive to selling.*

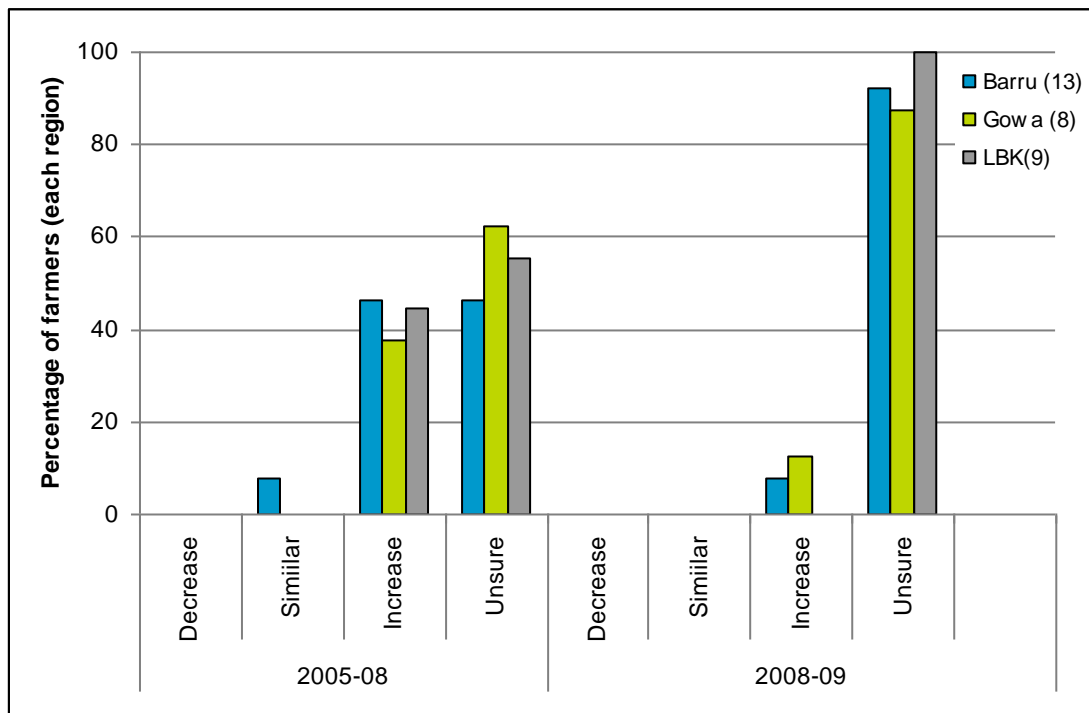


Figure 25. Perception of change in income as a result of the project. Comparison from project start to finish (2005-2008) and since project finish (2008-2009). Percentages refer to the percentage of farmers in each region (LBK = Lombok).

Changes in labour

Introduction of forage practices was expected to reduce labour demands related to cut and carry forage collection. Table 9 shows a decrease in average hours spent on cattle and forage management from 4.7 hours at the beginning of the project, to 1.9 hours in October 09 – around a 40% reduction in labour.

Table 9. Average hours each day spent by farmers on cattle/forage management activities

Location	Average hours/day spent in forage and cattle work		
	March 2005	February 2008	October 2009
Barru	4.3	2.5	2.0
Gowa	4.3	2.3	1.6
Lombok	5.5	2.6	2.1
All	4.7	2.4	1.9

There was a continued trend of labour saving from the end of the project to October 09, from 2.4 hours to 1.9 hours per day - equating to an additional 10% reduction on the original labour figure.

In Lombok, most farmers reinvested spare time into activities relating to improving their farm or off-farm work. In Barru there was a range of responses including: rest, crops and off-farm activity. Farmers in Gowa were less certain in regard to how freed labour was used, but over 20% of farmers invested labour in cropping activities (Figure 26).

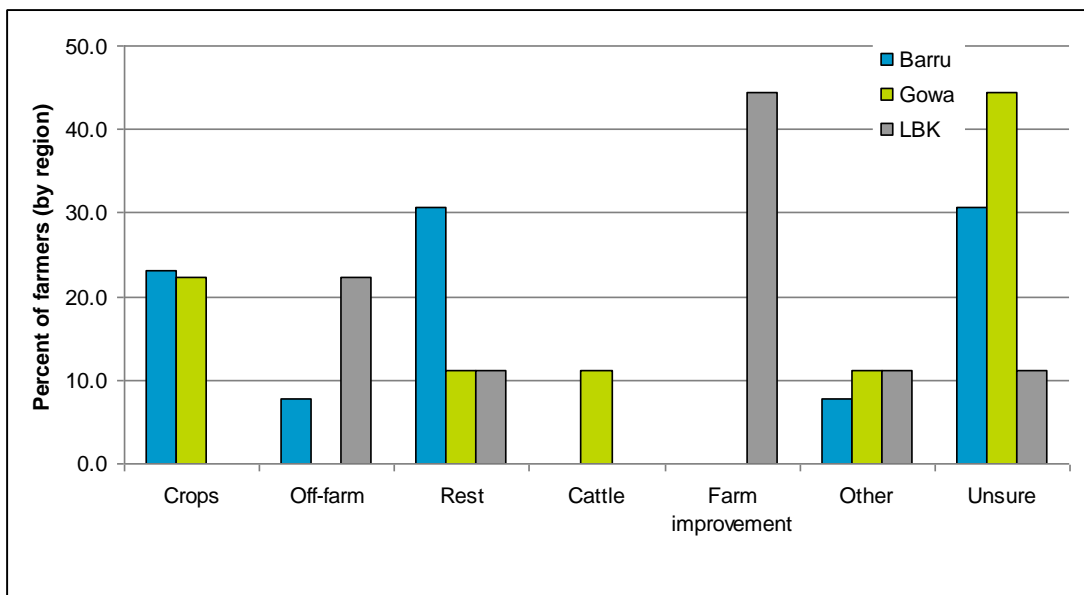


Figure 26. Use of freed labour, at October 09. Figure shows the number of farmers in each region and the activities freed labour has been reinvested in. Note that there may be more than one activity per farmer (LBK = Lombok).

Box 2. Impact case study: Harapan Village, Barru

At the beginning of the project, this farmer grew 2 rice crops on 1ha of bunded terraces, plus peanut or maize. He had 11 cattle, 2.5ha of upland land and 0.5ha of elephant grass. The size of both his landholdings and his herd put him above average in terms of resources and assets in comparison to other Harapan households.

He was initially slow to adopt all recommended best bet options. Only after observing the success of his neighbour, another best bet farmer, did this farmer decide to plant a small area of new grasses and legumes in his upland elephant grass area.

In the three years since this decision, the farmer has largely abandoned his upland maize production in favour of perennial forage production. He decided to buy 0.5 ha of upland specifically to expand the area of forage production. He also invested nearly Rp300,000 in fertiliser and land preparation for expanded forage production – around 40% of what he normally spends on crop production. This has been complemented by his decision to abandon free grazing for his cattle – with plans to build a substantial kandang in late 2010 to assist in his current practices of preferential feeding, early weaning and controlled mating.

With forage production in his upland field, the farmer saves about 3 hours each day looking after his cattle. Even though he has increased the area of forage, the labour saving has persisted. He uses the free time to spend with his grandchildren or rest.

He now plans to have up to 20 head of cattle including 10 cows, which he intends to support by further development and expansion of his upland forage banks.

This farmer highlights that adoption may not be immediate, even for relatively resource rich (and therefore low risk) farmers, and that delays in adoption do not necessarily indicate it will not occur. Reasons for delayed adoption vary but may suggest wanting to see proof of outcomes, resolving other labour commitments and so on. Despite this farmer's delayed start in comparison to others, he has made significant shifts in his farming system – preferring to expand forage production area at the expense of (non-rice) food production.

Box 3. Impact case study: Lompo Tengah Village, Barru

At the beginning of the project, this farmer had 0.17ha of lowland and 0.25ha of upland (most of which was share farmed). He had 3 cattle and 0.01ha of land for elephant grass. Compared to other best bet farmers, this farmer had fewer resources.

For the 3 years of the project, he struggled to successfully implement the recommended practices – largely due to disagreements over the use of shared upland areas. Once this was resolved (after the completion of the project), and with the support of other former best bet farmers, the farmer established a forage bank of 0.2ha, where he grew elephant grass and *Gliricidia*.

He has now largely stopped free grazing and practices cut and carry forage collection, feeds his cattle in his backyard and kandang and practices controlled mating (a bull is available from his neighbour). He has been able to increase his herd size to five.

By October 2009 the farmer reduced his average time spent shifting cattle and gathering forage from 3.5 to 1.5 hours/day due to development of his forage bank and switch to a cut and carry forage system.

This farmer provides an example of how the activities introduced by the project may persist without outside support, through farmer to farmer communication. While he had been involved in the project while it was active, his endeavours were largely unsuccessful due to land ownership and control issues. However once these were resolved, he was able to develop forage banks with the support (information, advice, resources) of former best bet farmers.

The broader impacts on this farmer's farming system are difficult to discern at this stage. He has been able to sell a bull for a price that he believes was above average for the age and class of the animal, and has also expanded his area of lowland share-cropping.

Box 4. Impact case study: Mertak village, Central Lombok

Drought and the subsequent lack of forage for cattle during the dry season are major challenges in Mertak village – to the point that many farmers regularly purchase truckloads of poor quality rice straw to supplement local feed supplies.

This farmer represents a fairly typical farmer in Mertak, with 1ha of lowland (mix of irrigated and rainfed) and 0.25ha of upland for rainfed cropping and cattle grazing. He had 5 cows at the beginning of the project, which were tether grazed year round.

This farmer was an enthusiastic best bet farmer: he quickly established small forage banks which he progressively expanded and built a kandang. He embraced the use of tree legumes, an existing resource on his land and in the common land around the village as an additional feed source.

With the increased feed resources, he was able to survive the dry season without buying rice straw. He was able to sell some of his cattle for increased prices, re-investing the money into infrastructure (dam for irrigation and a new house).

Since the end of the project, the farmer has shifted some of his land use away from cash cropping towards animal production by growing maize as a source of cattle feed. He believes it is more cost effective than trucking in rice straw through the dry, and less risky than investing in cash crops.

Although this farmer provides an exciting example of adoption and adaptation, he has since taken a position as a village extension officer. While this provides an excellent opportunity for the farmer to further share information on practices with other farmers (not to mention additional income), it is interesting to note that his son, who has taken over cattle management, has ceased the practices of early weaning and controlled mating.

7.5 Building and maintaining capacity

Summary

In this component, the project team focused on capacity activities with three key groups: the On Ground Team, the farming community and regional institutional stakeholders.

Building a suite of relevant technical skills was of prime importance to OGTs throughout the project. However as the project progressed, advanced abilities in problem solving and community engagement became as important as on-ground capability.

Farmer groups stated that engagement with the project had not only increased their skills and knowledge of improved livestock management practices, but also the social capital of the group, through increased cohesion, communication and cooperation. In particular, this has resulted in more advantageous engagement with local markets.

The project team observed significant changes in technical skills and requisite knowledge, the emergence of a deeper understanding of causal links between practice and benefit and enhanced problem solving skills in the farmer groups.

Regular, strategic engagement by the project team resulted in a greater awareness of the project and a strong influence in relevant regional institutions. Approaches include demonstrating the benefits of adoption, connecting key regional stakeholder groups, aligning the project with regional priorities, initiating knowledge transfer to external groups and supporting planning and policy activities.

7.5.1 OGT capacity

Throughout the project, the PST conducted both formal training sessions (refer to Table 6 for details) and weekly informal sessions for the OGT, on a range of topics – from forages and animal reproduction to modelling and extension practices. Both types of training were deemed to be essential to the success of the project.

Moreover, it was the intention of the PST to equip the OGT (and participating PPLs) with a highly transferable suite of knowledge, skills and contacts that would be valuable beyond the scope of the project and would potentially provide a capacity foundation for relevant livestock institutions in NTB.

Evaluation of training in May 2008 suggested that activities were considered both highly relevant to the participants' role in the project and beneficial to the knowledge and skill set of the participants post-project. In particular, OGTs ranked training in controlled mating, bull selection, forages and selection of farmer groups as most relevant to their project

work and of most benefit post-project. The content, appropriateness, timing and style of training were also rated well by participants.

In May 2009, a capacity evaluation exercise revealed that OGTs found training in social research, animal health, feed management and animal husbandry as the most useful training to help them in their project work. The more technical training around forage, husbandry and sanitation were deemed to be of most benefit to their farming communities.

They nominated knowledge (particularly about animal science), application of knowledge and dealing with communities as the most useful experiences and skills learned for their careers beyond the project.

In May 2010, OGT capacity was again evaluated, but as a reflection over the duration of the project. Table 10 shows the most cited responses to skills and knowledge gained as a direct result of project involvement, and most commonly cited use of the gained skill.

Table 10. Sulawesi and Lombok OGT reflections on key skills and knowledge gained during the project.

Skills or knowledge gained	Predominant use of gained skill
Improved farm management skills	Ability to select good bull, forage management, feeding management, good husbandry practices, animal health
Enhanced engagement, negotiation and communication skills	Building close relationship with farmers through continuous communication
Better understanding of social characteristics through social mapping and social benchmarking	Understanding farmer livelihoods and local culture
Ability to understand and analyse problems; to have a more focused and organised frame of thinking	Helping farmers solve problems in the field
Team work and networking	Learning from farmers; sharing and applying knowledge and experience

Clearly, the OGT felt that technical training in forage, husbandry and animal management skills were of primary importance to achieving project goals - this is reflected in their evaluations for years one and two.

As the project progressed, sound technical skills remained important for on-ground activities and project objectives, but problem solving and engagement gained prominence as transferable and useful skills.

The OGTs felt they needed additional skills in group dynamics to continue to support or enhance the capacity of their kandang groups.

In May 2010, members of the PST were asked for their perspectives on how the capacity of the OGT had grown over the course of the project. Their responses mirrored those of the OGT, in that technical knowledge and skills had been advanced (particularly in the areas of cattle management, forage and animal nutrition, data collection and integrated farming) and that these skills were important for completing the project. It was felt that capacity in these areas had been built primarily through training sessions and materials and interactions with PST members – both Indonesia and Australian.

In addition, PST respondents suggested that the capacity of OGTs to communicate and work with farmers had increased, as well as their ability to apply knowledge and solve problems in the field and to analyse and distil research outcomes. This was attributed to interactions with farmers, extension officers, village heads, PST members and the project team (including OGTs) from the sister project in Sulawesi.

Three other important points arose from the evaluation:

- Training is successful only if the trainees are receptive and enthusiastic. In general, this was the case with most training activities.
- The OGT can perform in an optimal way only if they are adequately resourced.
- OGTs develop and use knowledge and skills at different paces and in different ways. Self-motivation and attitude are also factors that can influence results.

In summary, the training and interactions brought about by project activities have provided an excellent foundation for OGTs as knowledge brokers, with OGTs as both keepers and effective deliverers of highly relevant information and expertise.

A pleasing post script is that in January 2011, three OGTs were accepted as Government employees – one in Dinas Peternakan, one in Dinas Pertanian and one in the office of statistics. One OGT was already on secondment from BPTP and another will likely join an upcoming ACIAR project in Timor Leste. In addition, six OGTs were successful in receiving Sarjana Membangun Desa funds ('Graduates Working with Villages' is a local government scheme providing 300 million Rp to successful animal science graduates for work on a village-nominated activity or objective) to continue development of their kandang group over the next three years.

7.5.2 Community capacity

Primary avenues for transfer of knowledge and skills between the project team and farmers were working alongside OGTs, engaging with PST members and interacting with participating kandang group members and other farmers. Each of these groups was asked to provide feedback on changes to farmer capacity as a result of participation in the project.

Project team feedback

In May 2010, OGTs and PSTs were asked for their views on significant changes to community capacity as a result of participating in the project. A summary of responses appears as Appendix 7.

Responses from PST members fell into two categories. The first comprised transfer of technical skills and requisite knowledge associated with project practices, eg forage management, animal nutrition and health, early weaning, breeding management, forage conservation and feed budgeting.

The second category suggested the emergence of deeper understanding of causal links between changed practices and increased productivity. Examples include early weaning resulting in calf growth, preferential feed of pregnant cows resulting in increased birth weight and the use of crop residues addressing feed shortages.

The OGT added a third category around improved problem solving skills for which farmers were becoming less reliant on OGT advice.

PST and OGT members suggested the most significant changes to individual capacity include increased confidence, status, business orientation and awareness of economic opportunity.

With respect to community changes, the most significant include increased communication and cooperation and more efficient use (and sharing) of communal resources.

As an example, Box 5 gives a chronology of bull purchases and sales, showing how the Rejeki Nomplok group was able to build sufficient funds to sustainably manage a resource initially provided by the project. This is made possible by empowering farmers to make collective decisions about bull management, as a group asset rather than as individual property.

Despite these changes, many OGTs felt that their kandang groups would need ongoing support and advice about adaptations and options beyond the project. While it was agreed that this support should be provided by PPLs, concern was expressed about the training, capacity building and resourcing that would be required to enable the PPLs to provide such guidance.

Box 5. Sustaining the selected bull: A case study of Rejeki Nomplok

For each kandang group the project contributed funds for the purchase of a quality bull to be used during the mating season (six months). It was decided that the bull must be sold after all cows have been mated and a new bull should be purchased prior to the next mating season. The price of a bull increases every year, so farmers need to ensure sufficient funds to meet this yearly purchase.

In Rejeki Nomplok group, a bull keeper was selected by the group to manage the bull for June to December 2008. A team comprising experienced farmers, OGT and PST made a decision to buy a bull in June 2008 for Rp 6,250,000.

The bull mated 84 cows from June to December 2008 (15 belong to group member and 69 from satellite). The mating fees were Rp 15,000 per head for group members and Rp 20,000 for satellite farmers. The bull was sold in late December 2008 for Rp 10,500,000 - a profit of Rp. 4,250,000.

During the 6 month mating season, the bull keeper generated an income of Rp 4,372,000 (Rp 1,185,000 from the mating fees and Rp 3,187,000 from selling the bull). He agreed to contribute Rp 1,483,000 to group saving (Rp 500,000 from mating fees and 25% of profit from selling the bull), creating a total group fund of Rp 7,733,000

The group considered that this amount was insufficient to buy a new bull for the next mating season in June 2009, so they decided to buy a young bull for fattening instead and to use the profits to increase the group funds before June.

They bought the young bull in January for Rp 5,500,000. However, cattle prices declined in May, so the group didn't make a profit from fattening the bull. After paying the bull keeper a small amount in compensation, the group fund was Rp 7,700,000 at the end of May.

In June 2009, the group selected and bought a bull for Rp 7,700,000 and sold it in February 2010 for Rp 11,100,000.

During the 2009 mating season, the bull mated 91 cows (23 from the group and 68 from satellite farmers) so the bull keeper generated an income of Rp 3,800,000 and contributed Rp 1,305,000 to the group, to make the group funds Rp 9,005,000.

Learning from the previous season, the group decided against buying another young bull for fattening and instead decided to make the group fund available for loans to group members with 15% interest. In May 2010, when the group retrieved all funds, the group fund was Rp 9,975,000.

In June 2010, the group purchased another bull for Rp 7,700,000, leaving Rp 2,275,000 in the group fund. The bull mated 88 cows in 2010, contributing Rp 440,000 to the group fund.

In early 2011, the group fund was already at a healthy Rp 10,415,000.

Farmer feedback

In November-December 2009, a survey was conducted with farmers from the first 23 kandangs (n=560 farmers) to gather information on the 'biggest changes brought about by the project' from the farmers' perspective. Results of the survey are summarised in Figure 27.

Of these response categories, three are directly related to farmer or community capacity – increases in human capital, increases in social capital and improved awareness of better sanitation.

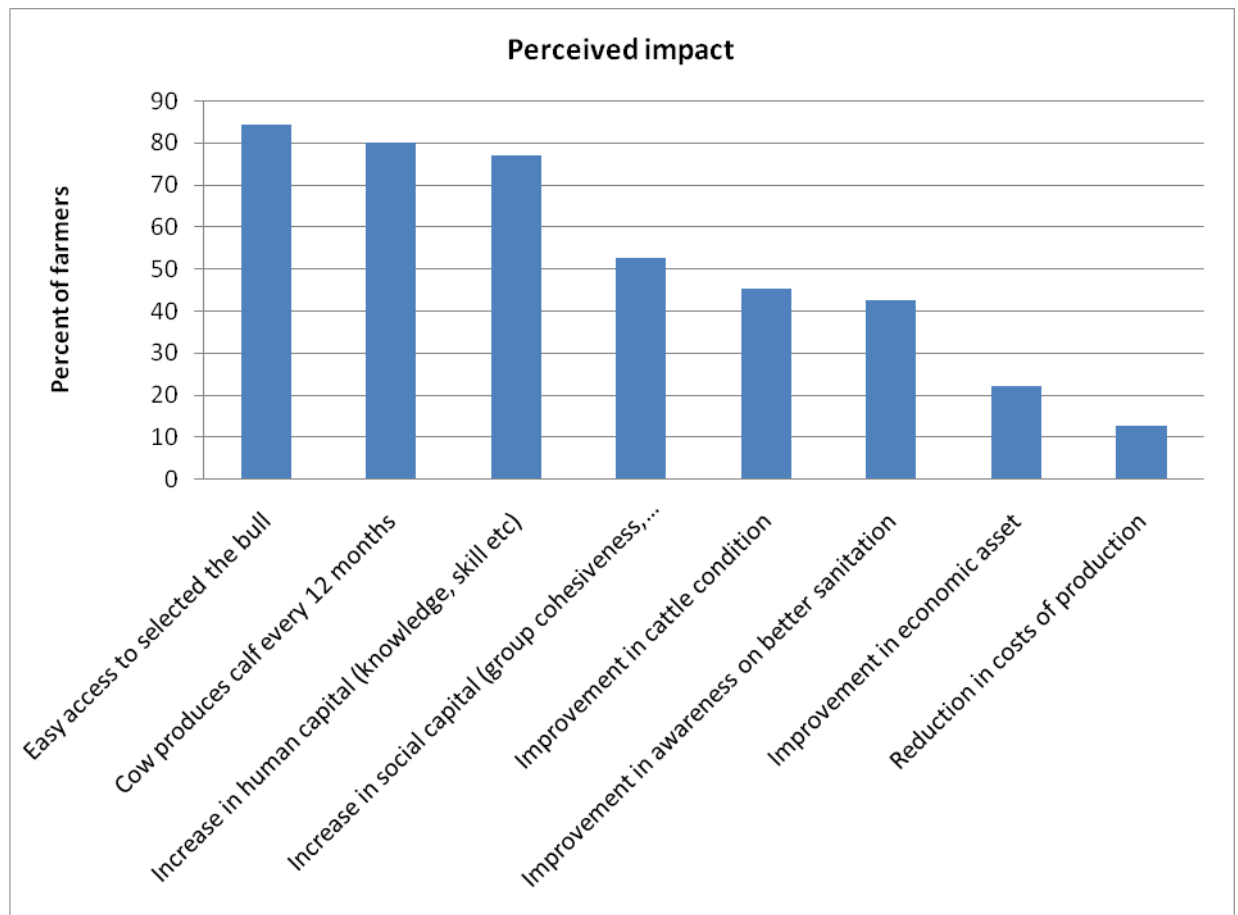


Figure 27. Perceived impacts of the project, as identified by farmers from the first 23 kandangs (n=560) in November-December 2009.

With respect to human capital, 77% of farmers claimed an increase in knowledge and skills associated with improved livestock management. Typical responses include increased awareness of the type and composition of forage needed for good animal health and growth, better understanding of oestrus and mating opportunities, greater security and knowing who to contact with problems.

Over 50% of farmers interviewed perceived an increase in social capital as a result of participating in the project. Examples of responses in this category include increased cooperation, cohesion and communication within the group, better connection to outside groups (including animal health authorities) and more instances of help between members when required (eg in times of illness or absence).

Over 40% of farmers stated that better understanding of kandang sanitation was a significant change brought about by the project. Typically, farmers cited an increased

awareness of the importance of animal health and linked this to kandang hygiene and improved feeding practices.

Other categories are more focussed to productivity benefits. However, responses from farmers in each category suggested increased knowledge – often arising from a demonstration of benefits - was an important contribution from the project. For example, easy access to a quality bull is only useful if a farmer also has the knowledge to detect oestrus. Similarly, producing a calf every 12 months is possible once farmers are convinced that earlier weaning does not negatively affect the health of cows or calves.

In June 2010, farmers from a subset of villages were asked to assess the process and impact of the project on their farm systems, management and capacity. Boxes 6 and 7 provide examples of significant outcomes felt by farmers in response to project activities.

Box 6. Microloans and marketing in Sumber Rejeki

Before the project, Sumber Rejeki farmers felt disorganised as a group. They had little money for household expenses or capital purchases. Subsequently, they felt forced to sell cattle – even young calves – when even a relatively small amount of cash was needed and were vulnerable to trader negotiations.

A number of linked outcomes were observed by the group as a result of project activities.

The group established a 'sales management division' which is charged with gathering and sharing market information with members. Traders now negotiate with the kandang group, rather than with individual farmers, which has resulted in higher sales prices. A small commission is taken for each sale, which is returned to group funds for use in kandang improvements, future bull purchases and microloans.

This positive market response has increased farmer awareness of the links between nutrition, timely breeding, productivity and sales. Overall farmers feel they not only have more money, but a regular source of income.

Importantly, the development of a microloan system (as a result of the project's bull purchase and management arrangement) means farmers can now access small amounts of money while retaining young animals until the selling price is optimal.

Box 7. Forage production and labour saving in Montong Pentil

Only five farmers in the Montong Pentil group of 16 own their own land. Native grasses and rice straw were the main components of the diet of the village's cattle. Before the project, farmers spent up to five hours a day collecting forage outside the village – in some cases as far away as West Lombok. Around the village, farmers competed with each other for available native forage resources.

Provision of knowledge and advice about new types of forage and the nutritional value of tree legumes has resulted in expansion of existing forage areas, planting of forage banks on all available land (particularly bunds) and strategic feeding of improved grass-legume mixes to calves and cows. Some farmers have even converted unused upland or cash cropping areas to forage production.

With better diets, calf growth and survival have improved and sale prices are higher. Farmers are now enjoying a higher income from cattle and are investing in house improvements, school fees and vehicles.

An equally important outcome has been a daily labour saving of up to 4 hours for some farmers due to improved production, location and use of forage resources. The majority of farmers in the group are using saved labour to earn off farm income.

An additional outcome for the group has arisen through sharing of resources. Farmers with land are planting more forages and contributing cuttings and seed to the group. This has eased competition amongst landless farmers for native grasses on communal land

7.5.3 Institutional capacity

The Lombok project team have been regularly engaging with institutional and government staff at provincial and local levels to build on existing relationships and to identify synergies and opportunities for collaboration. A number of vehicles were used to catalyse engagement and their success and effect are discussed.

Program Advisory Committee

The PAC was an important mechanism for discussion on the direction and relevance of the project to regional and institutional initiatives and targets. Meetings were also a catalyst for senior representatives of allied institutions to interact and discuss common challenges. Minutes of the PAC meetings appear as Appendix 4 and membership is detailed in Table 4.

The PAC expressed general satisfaction with the progress of the project, particularly with the philosophy of working closely with the farming community rather than just providing funds or structures. The project approach was appreciated as simple, but with a high impact, and farmer participation, empowerment and independence were seen as crucial to adoption and success.

In addition, there were six topics that featured strongly in PAC discussions.

1. Increasing cattle population Increasing NTB's cattle population was seen as a major challenge. The committee agreed that while there is potential to increase productivity across the two systems of NTB (carrying capacity 200,000 animals; current population 75,000), in addition to increasing numbers, effort is needed to retain productive animals and reducing exports to other islands. Obstacles suggested by the committee included farmer education, inbreeding, disease, lack of feed, slaughter of productive females and low birth rates.

2. Aligning with regional priorities It was noted that that project outputs were well aligned to regional policy initiatives such as the NTB's Bumi Sejuta Sapi (BSS), or Land of a Million Cattle initiative. It was felt that three components that could contribute significantly to regional initiatives were bull management, improved kandang management and controlling slaughter of productive females. Further, because of the project's location and success, there was consensus that Central Lombok was in a good strategic position to be a learning site for the rest of NTB and nationally.

3. Replication, expansion and training However, there was also much discussion about how to replicate and expand 'the ACIAR model'²² to other districts (in Central Lombok and other parts of NTB) and institutes. There was agreement of the importance of the extension services in increasing livestock production in the region and frequent suggestions that the project provide assistance to improve capacity of extension staff, using PST and OGT for training.

4. Collaboration and communication The need for strong collaboration and regular communication between key regional stakeholders – irrespective of the project finishing date - was a recurring sentiment. The project team was also urged to maintain strong relationships with local government, farmer groups and other research groups working in the region.

²² 'The ACIAR model' is how farmers and some institutional staff refer to the project approach; includes participatory planning and monitoring, introduction of project practices into a communal system and ongoing engagement and learning between farmers and the project team.

5. Sustainability of project success There was much related discussion around the need for an exit strategy from the project and about sustainability of the work more broadly. There was general commitment towards longer term activities and collaboration, with suggestions including: more active involvement of PPLs, vehicles to influence local government policy and the development of an ongoing collaborative network.

6. OGT as a resource In all meetings, the importance of OGT to the success of the project was recognised by committee members. Potential roles were discussed, acknowledging that the OGT are highly skilled, motivated field staff. The value of maintaining other project assets was also discussed, particularly experienced kandang groups, bulls and good system of information exchange.

Accordingly, when asked in May 2010 for areas of future research activity, PAC responses included:

- Reducing calf mortality, as a means to increase NTB's cattle population
- Studying the issue of cow selling (timing, location, reasons)
- Developing an incentive system to retain productive females, including livestock identity cards to monitor cattle traffic between districts
- Strengthening commitment by policy makers for increasing livestock productivity
- Improving the genetic background of Bali cattle through breeding programs
- Establishing an evaluation system for cows and bulls (genotypically and productively)
- Expanding project success by using 36 project groups as a model for 360 groups in Central Lombok in the next five years.

Two of these issues – policy development and livestock identity cards - are being addressed in a collaborative project coordinated by ANTARA-AusAID. This activity has used project data and outcomes to develop and implement strategic plans for improving livestock productivity in NTB in the form of Bupati decrees (for more information, visit www.antarrantt.org)

Two of these issues – calf mortality and cow selling - are being addressed in an ACIAR extension activity, beginning in July 2010. Key partners are UNRAM and BPTP NTB.

Project influence

At the start of the project, the project team developed a strategy for institutional engagement, with a goal to embed successful elements of the project into regional and local institutions, initiatives and policy.

Table 11 provides examples of significant influence with various groups. Clearly, there is a high degree of overlap with the activities suggested by the PAC.

Table 11. Institutions and groups with whom engagement was sought by the project team on the issue of increasing livestock productivity in mixed systems in Lombok.

Level of influence	Institute or group	Reason for engagement	Examples of significant project influence
Provincial (NTB)	Dinas Peternakan	Custodian of provincial livestock policy; input into provincial planning on livestock issues	<p>Changed ratio for bull service from 1:10 to 1:50</p> <p>Increased number of bull purchases for distribution to FG, for natural mating, not fattening</p> <p>Funds for bull purchases now directly to FG account</p> <p>Focus shift from artificial insemination to controlled natural mating</p> <p>Shift in government preference for Bali cattle</p> <p>Funding support to FG to improve sanitation</p> <p>Project outputs used for planning and policy development (Antara)</p> <p>Study kandang used as model for Village Breeding Centres – a potential vehicle for replication across NTB</p> <p>Successful Calf Harvest supported by project team</p> <p>Regular interaction with other PAC members</p>
	Extension Office	Responsible for delivery of agricultural information to farmers	<p>Regular interaction with other PAC members</p> <p>Study kandang used as learning sites for PPLs</p> <p>PPL training as part of Bank of Indonesia initiative (see below)</p>
	Bappeda NTB	Provincial planning and funding across all sectors	<p>Project Leader and Coordinator on BSS Task Force (chaired by Kepala Bappeda)</p> <p>PST helped develop proposal for cattle breeding in sub-districts of central Lombok, based on project management framework</p> <p>Project Coordinator on team to synergise Governor's policies</p> <p>Project outputs used for planning and policy development (Antara)</p> <p>Regular interaction with other PAC members</p>
	Governor's office	Provincial planning, policy and	Project Leader and Coordinator on BSS Task Force (reports directly to Governor)

		funding across all sectors	<p>'One cow, one calf, one year' adopted as the BSS slogan</p> <p>Project aligned with provincial government contribution to national plan for beef self-sufficiency program</p> <p>Project outputs used for planning and policy development (Antara)</p> <p>Project Coordinator on team to synergise Governor's economic development programs</p>
District (Central Lombok)	Bupati's Office	Responsible for activities of Dinas and Extension at district level	<p>Central Lombok declared source of Bali cattle breeding stock</p> <p>Successful Calf Harvest supported by project team</p> <p>PST helped develop proposal for cattle breeding in sub-districts of central Lombok, based on project management framework</p> <p>Regular interaction with other PAC members</p>
	Dinas Peternakan	Implement provincial livestock policy; engage with farmers on technical livestock issues	<p>Successful Calf Harvest supported by project team</p> <p>PPL training conducted by OGTs and PST</p> <p>Purchase of 40 bulls for FG in Central Lombok</p> <p>Regular interaction with other PAC members</p>
	Extension Office	Engage with farmers on agricultural issues; potential custodians of knowledge and skills post-project	<p>Implementation of project package in 10 villages</p> <p>PPL training conducted by OGTs and PST</p> <p>OGT facilitation of farmer training as part of FMA program</p> <p>Regular interaction with other PAC members</p>
External	Other research groups	Synergies between projects; shared resources and information	<p>ACIAR beef supply chain project uses project data</p> <p>Regional JICA project aware of project approach</p> <p>Dinas staff in JICA project trained in group selection by PST</p> <p>New ACIAR projects (Poppi, Shelton) aware of project; adopted OGT model</p> <p>ANTARA project on policy developed established with project results</p>
	NGOs	Potential dissemination of information and skills	No significant influence so far

In review, successful project influence was achieved by the project team in five key ways.

1. Demonstrating benefits

The changes to Dinas and Penyuluhan policy were not instantaneous, but were a response to a demonstration of the benefits of applying project practices. By working closely with farming communities, the project team was able to quickly implement practices and to show positive outcomes in a short period of time. In this way, Dinas and Penyuluhan were able to observe first hand that some longstanding practices could be updated.

Significant examples include the switch from providing females and young males to farmer groups, to providing quality bulls (thereby ensuring both genetic diversity and controlled mating), and the change of assumed bull service ratio from 1 bull: 10 cows to 1 bull: 50 cows or more without compromising pregnancy rate.

2. Connecting key regional stakeholders

As previously stated, the PAC meetings provided a vehicle for senior representatives of allied regional institutions to meet and discuss common challenges in improving livestock productivity, to search for synergies in existing activities and to plan for the future.

Similarly, participation on advisory committees, task forces and working groups has enabled the project team to influence visioning and planning processes and to ensure project relevance.

3. Aligning with regional priorities

The most significant regional initiative to arise during the project has been the Bumi Sejuta Sapi initiative (Land of a Million Cattle). BSS provided a great opportunity for the project to align its approach and outcomes with NTB's nested support for the national beef self sufficiency objective.

A provincial task force, led by the Head of Bappeda and reporting to the Governor, was established to plan for this vision. A significant indication of the project's influence is that the Project Leader and Project Coordinator were both invited to join the small task force, placing the project in a good position to influence policy and planning, and ensuring connections between research and development activities and stakeholders.

4. Knowledge transfer and training

Throughout the project, training was conducted by the project team for Dinas and Penyuluhan staff, thereby enhancing the likelihood of project practices and approach becoming embedded in these two important institutions.

An unexpected success has arisen from a partnership with the Bank of Indonesia to provide training to Dinas staff and farmers and to implement the project model in other areas of NTB, including districts of North Sumbawa and East, North and West Lombok.

In the final year of the project, a number of the OGT became involved in training and capacity building for farmers, facilitators and schools.

In addition to training, the project team hosted visits and delegations from numerous regional stakeholders, including the Ministry of Agriculture, Fisheries and Forestry and the Rural Development Project of Timor Leste, and farmers, village heads and extension officers from East Lombok.

5. Supporting planning and policy activities

Project results - particularly increased productivity indicators and farmer group empowerment - became the foundation of a collaborative activity between ANTARA-AusAID and UNRAM looking at incorporating positive research results into local policy outcomes.

"Supporting research outcomes to establish local government policy on Bali cattle breeding in West Nusa Tenggara province" aimed to enhance local government policies (particularly with Bupatis) to allow implementation of a strategic plan for Bali cattle

breeding. Particular focus was on pricing and grading mechanisms, identification systems for animal monitoring and the use of collective pens in long term planning.

The initiative has captured the interest of key stakeholder groups, including the Governor's office, Dinas Peternakan, the Director General of Livestock Services and members of the provincial legislature, and is the project team's first occasion of creating policy on paper from research results.

8 Impacts

8.1 Scientific impacts – now and in 5 years

The scientific methods used were not exclusive to this project but are an affirmation of the approach developed over a series of ACIAR projects on livestock improvement in Lombok, NTB and South Sulawesi. Continued academic exposure through publications and conferences is expected to yield interest in the approach and changes in scientific practices of other research groups.

The most significant science impact to arise from the project will be the dissemination of project principles and practices through regional university curricula, thus influencing the next generation of agricultural researchers, extension staff and academics. UNRAM staff noted that the Faculty of Science “has adjusted its approach from theoretical concepts to contextual ones with real outcomes”.

Aspects of the project have been incorporated into UNRAM teaching programs (Dahlanuddin, Sutaryono, Zaenuri, Hermansyah). Lecture topics include integrated production systems, herd management and forage agronomy, production and use. In addition, the Integrated Analysis Tool and project data are used as teaching tools and materials, particularly in discussions about farming systems.

In addition, UNRAM students regularly visit the University’s farm at Lingsar as part of pasture and forage management units. Not only do students view forages, feeding practices and the benefits of adoption of project practices, they are also exposed to the participatory philosophy and farming systems approach behind the project.

The project has also influenced teaching staff at Gadjah Mada University in Yogyakarta through co-supervision of the project’s PhD student and subsequent interactions and presentations.

8.2 Capacity impacts – now and in 5 years

The project built knowledge and skills in two key groups – the On Ground Team and the farming community.

The OGTs are a group of well trained, and now experienced, field workers – a fact that has been noted and acknowledged by the Program Advisory Committee and other relevant stakeholders. The inclusion of OGTs as the interface between researchers and farmers has been a cornerstone of information delivery in this project. They have sound technical skills, proficiency in identifying and solving problems and expertise in community engagement and negotiation. Many have also played a mentoring or advisory role to others (particularly PPLs) either through formal training or informal engagement.

The OGT model for extension has proven to be advantageous and is now being replicated in at least two other ACIAR projects in Indonesia. Its success lies in the OGT’s knowledge and accessibility and also in the fact that they were adequately trained and resourced to meet project objectives. In Lombok, the capacity built in these young graduates is now starting to be realised with almost all OGTs either taking government positions or gaining SMD funds for the next three years.

However, to replicate this in Dinas or Penyuluhan requires significant increases in resources – both human (through training) and financial (through incentives, provision of equipment or remuneration). The visible benefits of the project, its high profile, the accessibility of the PST and the influence the project has had in high levels of government shows promise that capacity impacts may flow into these government agencies within five years.

In their feedback, the majority of kandang group farmers felt that they had acquired enhanced technical skills and requisite knowledge about project practices. The project team also noted a better understanding of causal links between changed practices and increased productivity and stronger problem solving skills, resulting in greater farmer confidence. In many kandangs, better cohesion between group members has led to more efficient use of communal resources and a shift towards a stronger business focus for the group.

For the farming community in general, the capacity impacts of the project in five years are unclear. Although capacity of participating farmers has been significantly raised, feedback suggests that the 'expert knowledge' and accessible advice provided by OGTs - or their PPL equivalents - is still in demand if productivity and livelihoods benefits are to be felt beyond the project.

Although engagement between satellite farmers and group farmers was high over the use of the project bull, the project's social research revealed that little context or additional information about the project was disseminated by the project groups. Satellite farmers who did adopt project practices did so after repeated discussions and observation of benefits that were supported by close proximity or other connection (eg family or former group member) to the project groups.

In general, project influence reached only 1km from the project group (the distance farmers were willing to travel to use the services of the project bull and hence address their most pressing production constraint). Natural expansion of knowledge and skills to achieve widespread geographical benefits seems unlikely without uptake and ownership by local and regional livestock agencies.

8.3 Community impacts – now and in 5 years

8.3.1 Economic impacts

The key economic impact from the project is increased sales resulting from effective breeding management and better nutrition and hygiene. Conception and calving rates have increased, mortality rates and inter-calving intervals have decreased, and birth weights, weaning weights and growth between birth and weaning are all higher than the NTB average.

In a location where land (and therefore forage) resources are constrained, farmers have chosen to increase throughput rather than herd size, thereby increasing frequency of sales. Because better nutrition is fuelling higher growth rates, animals can be sold earlier for the same price, limiting demand on feed supply and labour. In two years, the number of cattle sold has increased by over 60%.

Using the productivity figures achieved by the project groups (compared to existing NTB figures) and extrapolating over five years, adoption of project practices could increase the number of animals sold by over 80% and more than double the quantity of beef produced and sold (see Appendix 8 for analysis).

The geographical spread of economic benefits is greatly dependent on uptake of project practices by local and provincial agencies. The project worked closely with 36 kandang groups (approximately 1100 households) over the three year project, without considering satellite farmer households. If agricultural agencies worked with only 12 more kandang groups annually for the next five years, over 3200 households would potentially experience economic benefits.

Further, if agency ownership could be achieved, Martin (2010) estimates that 5% adoption (equivalent to 11 000 farmers) could be achieved by 2023. With extension as has been provided by this project, he estimates that this figure could be achieved by 2018 (and 16% or 34 000 farmers could be achieved by 2023).

In addition, there are a number of commercial opportunities that have emerged amongst project groups, including:

- **Bull keeping as a business:** An elected bull keeper has two sources of income – mating fees and profit from the sale of a bull (see Box 5). If the group is able to collectively make decisions around bull purchase and sale, bull keeping is potentially a lucrative and sustainable business, and the model is expanding throughout Central Lombok.
- **Forage production as a business:** A growing number of farmers are becoming aware of the financial potential of growing forage. These farmers are replacing cropping land (food and fibre) with improved forage after comparing the market price of each commodity.
- **Group-based microfinance:** As a result of sustainable bull purchase and management, microloan systems have been developed in many project groups. The microloans mean that farmers can now access small amounts of money instead of having to sell animals when even a relatively small amount of cash is needed.
- **Marketing as a group activity:** In a number of kandang, traders are now negotiating with selected members representing the group, rather than individual farmers. This has resulted in higher sales prices (a commission is returned to group funds).

8.3.2 Social impacts

The clearest impact arising from the project is the perception by many participating farmers of enhanced social capital.

Farmers and the project team observed greater cooperation, communication and cohesion within the group and more motivation to work collectively, and resulted in pride in achievement, elevated community status and healthy competition with other farmer groups around breeding outcomes, bull performance and kandang renovations in particular.

These changes in attitude and self belief work through the groups' social networks to promote collective action for mutual benefit (as defined by Uphoff (2005)). The project supported these changes in behaviour and social relationships through continuous group negotiation sessions to reach agreement on issues such as bull management, contribution to infrastructure improvements and management of group finances.

As a result, the dynamics in many groups has changed. Whereas decisions were formerly made by the group leader only, it is now more common for groups to discuss options, negotiate and look for consensus.

In five years, it is anticipated that the social capital in participating groups would remain high, with ongoing confirmation from economic success. This is likely to lead to greater opportunities in areas such as education, health and equity.

Patrick (2010) identified the potential role of social capital in improving market access for smallholder farmers. His work suggested that government development programs using farmer groups to deliver cattle should also aim to foster group trust and good leadership if they wish to move beyond short term smallholder welfare to better market connectivity and industry efficiency. The elevated levels of social capital are a positive indication of such a shift in the project groups.

As for economic impacts, it is unlikely that social impacts will expand spontaneously in other kandang groups, without the input of a selected bull, seed funding for infrastructure and the information and support provided by OGTs or equivalent government staff.

8.3.3 Environmental impacts

Where possible and practicable, the project team promoted cost effective practices that could lead to greater sustainability in farm resources. In five years, those practices that have also resulted in productivity benefits are likely to be embedded in day to day farm management.

There is evidence of significant improvements in kandang drainage and manure collection for subsequent use as fertiliser, either directly applied to forage or crops, or as bokasi²³. While not part of the project's technology package, the use of fertiliser has been widely promoted and demonstrated to study communities by the PST and OGTs and is an incentive for kandang improvements that is related to an improved understanding of the importance of animal health for productivity.

The increasing trend in use of organic practices was also viewed as a potential economic opportunity for farmers. In support, results from the project's Masters student indicate significant increases in productivity, nutritive value and digestibility of Mulato under organic fertiliser. These results have been disseminated to farmers in the study kandangs.

Effort was made by the project team to establish and promote local forage species where possible (that is, forages that are already available in the region, such as native grasses and legumes) and to provide awareness of species that may tend towards weediness, toxicity or other environmental or health problems. In some instances, weedy species were replaced by other species such as *Gliricidia*. In most cases, introduced forages were considered highly unlikely to become weedy as regular cutting gave plants little opportunity to set seed. For this reason, perennials were favoured over annuals.

Increased use of new forages or expansion of existing forages in vacant land or along bunds is likely to have reduced overgrazing in communal areas and reduced grazing pressure on native vegetation.

²³ *Fermented organic matter.*

8.4 Communication and dissemination activities

As the success of the project relied on dissemination of information and engagement with institutional and community stakeholders, many communication activities have already been discussed. Highlights and additional activities follow.

Conferences and seminars

The project was represented at a range of conferences and workshops including:

- International Grasslands Congress/International Rangelands Congress – Hohhot China, July 2008
- Thirteenth Animal Science Congress – Hanoi, Vietnam, September 2008
- National Seminar on beef cattle development to support national beef self sufficiency program – Palu, Indonesia, November 2008.
- National Seminar on improving Bali cattle production under village rearing systems in eastern Indonesia - Kupang, Indonesia, November 2008.
- Knowing Animals Conference - Florence, Italy, March 2009
- National Seminar on smallholder Bali cattle production - Mataram, Lombok, October 2009.
- Fifth Viennese Conference on Southeast Asian Studies – Vienna, Austria, May 2010.

A National Seminar on smallholder Bali cattle production was held in Mataram in October 2009 as a parallel promotion for the Central Lombok Calf Harvest. The project team were on the organising committee and the event was hosted by UNRAM. It was attended by nearly 100 people and participants included universities in Sulawesi, Bali and NTB, the Research Center for Animal Science in Bogor and Dinas Peternakan from nine provinces. The keynote address was given by the secretary to the Director General of Livestock Services. Proceedings of the seminar were published (in Indonesian) by the SADI office as an ACIAR Monograph.

Institutional stakeholder engagement

Regular, strategic engagement by the Indonesian project team resulted in a strong awareness of the project in relevant regional institutions, particularly Dinas Peternakan, the Extension Office, Bappeda and the Office of the Bupati of Central Lombok.

The Program Advisory Committee meetings were an important mechanism for discussion of the direction and relevance of the project to regional initiatives and targets. Meetings were also a catalyst for senior representatives of allied institutions to interact and discuss common challenges and plan for the future.

In addition, communication of project results and potential was achieved through participation by project team members in key regional working groups and task forces, including the Governor's taskforce for the Bumi Sejuta Sapi Initiative, Bappeda's working group to develop proposals for cattle breeding in Central Lombok, a working group to synergise the new Governor's policies and the team formed by the Bupati to plan and implement the Central Lombok Calf Harvest.

See Section 7.5.3 for further details.

Farmer engagement

The nature of the project necessitated daily interactions between farmers and OGTs and regular but less frequent visits between PST, OGT and village leaders.

Specific project activities to support farmer to farmer interactions include facilitating visits by new kandang groups to established kandang groups (to demonstrate and discuss the benefits of project activities) and to the university farm at Lingsar (to observe forage establishment, growth and feeding techniques) and coordinating farmer field days and on-farm workshops.

Promotional activities

The largest promotional activity was the Calf Harvest which was hosted by the Bupati of Central Lombok and officially opened by the NTB Governor in October 2009. The event was coordinated by Dinas Peternakan to showcase NTB's Bumi Sejuta Sapi initiative and how Central Lombok's livestock improvement activities were supporting this initiative, the Bupati's wish to become the Centre for Bali Cattle Breeding and NTB's support for the national beef self sufficiency objective.

The event was hugely successful, with around 400 calves and 400 cows brought to Praya market by project farmers and satellites from three villages around Kelebu. Over 1000 people attended from local communities, other districts in NTB and other provinces.

In their addresses, the Bupati and the Head of Dinas Peternakan NTB acknowledged ACIAR's support in funding research projects in Central Lombok since 2001. The achievements in calving rate, birth and weaning weights and calf mortalities of the 096 project were particularly noted as a great support to the BSS movement.

Other promotional activities included the production and distribution of displays, posters and handouts, for use in training, farmer events and at the project kandangs. These materials, which featured the project's objective of 'one cow, one calf, one year' and information on how to achieve it, were designed by the project team and reviewed and improved by project farmers.

Media interactions include: coverage in major NTB newspapers (Nurani Rakyat and Suara) following a visit by the project team to the Bupati's residence in late 2007; visiting journalists featuring the project in a Radio Kang GURU program airing in Australia and Indonesia in April 2009, a visit by an Australian freelance journalist resulting in feature story for ACIAR's Partners magazine (*Enabling more secure livelihoods in uncertain times*; March-June 2009); coverage of the project by a journalist from the leading national newspaper Kompas in August 2009 (printed in January 2010); a visit from Sky News team resulting in a 30 minute segment aired in February 2010; live coverage of the Calf Harvest national radio RRI and delayed broadcast nationally by TVRI and RCTI.

Eight editions of a project newsletter were produced and distributed (in Indonesian and English) to relevant institutions in Lombok, South Sulawesi and Australia.

Project Coordination Meetings

Instead of annual meetings in Australia, the project team agreed to hold joint meetings between the Sulawesi, Lombok and Australian teams in Indonesia. These Project Coordination Meetings were opportunities to review progress and plans, exchange ideas and information and to form networks for the future. They were attended by PST, OGT, PSC and selected PPLs.

Three joint meetings were held: the first in Makassar (South Sulawesi) in July 2008; the second in Senggigi (Lombok) in June 2009 and the third in Sanur (Bali) in May 2010.

Visits and reviews

Throughout the course of the project, the Indonesian project team hosted many international and national visitors and delegations interested in the design and progress of the project. Institutions represented by the visitors included ACIAR, SADI, ANTARA, CSIRO, Timor Leste's Ministry of Agriculture and Forestry, Department of Primary Industries of Northern Territory, University of Queensland, Utah State University, Charles Darwin University, Gadjah Mada University and Padjadjaran University.

Three international review teams visited the project team and sites: a SADI review team in Nov 08, an ACIAR-appointed reviewer looking at forage research investment in eastern Indonesia in June 2009 and an AusAID-appointed team reviewing Australia's foreign aid investment in Indonesia in January 2011.

9 Conclusions and recommendations

9.1 Conclusions

The project team made a range of successful research, community and institutional advances. In terms of addressing the project objectives:

There are likely to be lasting improvements to Bali cattle production in the study region. The productivity gains for farmers are significant (calving rate of around 90%, with calf survival of around 95% and a calving interval of just over 12 months) and support a strategy whereby increased reproductive potential can be realised and converted to greater throughput and increased sales without overt strain on other resources.

The increased productivity supports both provincial and national initiatives for beef, breeding stock and economic development in the region. Already there has been wide institutional acknowledgement of the project benefits and there is evidence – including policy changes – of continued provincial and local support for the project approach.

In addition to economic benefits, the welfare and security of participating households has been enhanced through transfer and implementation of technical skills and knowledge of livestock management practices and through improved cohesion, cooperation and communication within the participating kandang groups.

With respect to further understanding adoption, project findings include:

- Whether or not households choose to adopt new practices depends on their perception of risk and how they perceive and prioritise different activities in their livelihood portfolio.
- Project practices were built on existing knowledge and infrastructure and this has made their adoption less difficult for some households.
- However, physical resources constrain adoption, regardless of intent.
- Important mechanisms for spreading information within a community include farmer interactions (including visits), the On Ground Team members (OGTs), the local mosque and family networks.
- The provision of a bull service (whereby farmers not formally associated with the kandang group interact with group members) was thought to be a good catalyst for dissemination of project information. In reality, the opportunity was not fully realised and support for potential spokespeople would need to be provided in future.

More widespread benefit and impact across NTB would require adoption of project elements by relevant agencies. In particular, it should be noted that:

- Investment would be needed in training and appropriately resourcing the equivalent of OGTs to work closely with farmers to achieve social and economic benefits.
- Success in the project was due not only to addressing the farming community's biggest production constraint – access to a quality bull – but also to providing a means to sustainably manage that resource.
- Spontaneous farmer to farmer interactions are unlikely to provide significant or timely scale out of project practices between kandang groups (or between kandang and non-kandang groups) over large distances. In areas where collective farming is predominant, replication across an increased number of kandangs seems more viable. More study would be needed to determine effective strategies in areas of distributed farming.

There was considerable investment by the project team in strategic engagement with institutional and government groups at provincial and local levels, to build on existing relationships and to identify synergies and opportunities for collaboration. Successful scaling up strategies employed by the project team that may be widely applicable include:

- Demonstrating positive outcomes: Changes to Dinas and Extension policy (as a result of project activities) were not instantaneous, but were a response to a demonstration by farmers of the benefits of applying project practices.
- Connecting key regional stakeholders: Advisory committees, regional task forces and working groups provided a means for senior representatives of allied regional institutions to meet and discuss common challenges in improving livestock productivity and enabled the project team to influence visioning and planning processes and to ensure project relevance.
- Aligning with regional priorities: Identifying and actively supporting regional initiatives (such as the Bumi Sejuta Sapi initiative) provided a great opportunity for the project to align its approach and outcomes to a government cause. Again, this enabled policy and planning influence and ensured connections between research and development activities and key stakeholder directions.
- Knowledge transfer and training: Capacity building and training of relevant groups (particularly Dinas and Extension staff, farmer groups, facilitators and schools) enhanced the likelihood of project practices and approaches becoming embedded in key government and social institutions.

9.2 Recommendations

Recommendations for future activities from this project

There is general agreement that while the original three year project timeframe is adequate for assessing changes in farm practices and productivity, it is insufficient to gauge what effect these changes will have on farmer livelihoods. A detailed livelihoods assessment of a subset of farmers is recommended, with a focus on exploring social outcomes and impacts.

To address Advisory Committee suggestions and further consolidate project outcomes, the following research activities are recommended:

- Investigation into the causes of calf mortality in study kandang - in particular, to look for connections with preventative approaches (nutrition, hygiene) and curative approaches (medicine).
- Study of cow selling, particularly the reasons that farmers sell different classes of animals at different times of the year, with a view to developing policy solutions to the issue of retention of productive females
- Expansion of the project approach to other areas of NTB, with a view to comparing productivity benefits and livelihood strategies between collective and distributed systems. This activity would require forming a detailed understanding of the farming, social and institutional systems of the new region.

General recommendations for similar research

- The project model of employing and training young graduates was instrumental in providing ongoing support and encouragement to farmers. Due to resourcing and other commitments, it is unlikely that the success of the project would have been achieved using existing extension staff. The OGT model is recommended for projects requiring regular and effective community engagement.

- Further, projects with a strong focus on extending project impact need a well funded component that delivers new capability, builds links to farmers and provides ongoing learning to change agents (such as OGTs and extension staff). Ideally, such a model could be considered as supporting under-trained and under-resourced extension services, rather than threatening them.
- It is important to engage early and often with people and offices responsible for resourcing at the intended scale of impact. In this project, strong relationships with District and Provincial Dinas and Extension staff and Bappeda staff, along with ongoing support from the Governor's Office and the Bupati of Central Lombok have resulted in policy linkages and institutional relevance.
- The project showed the value of financial co-investment (eg for infrastructure improvements and bull purchases) to community development – if the investment is paired with improved governance and operational structures (eg group decision making, agreements on bull management). Feedback from farming groups about enhanced cohesion, communication and motivation to work for communal benefit supports the idea that co-investment may be at least as effective as donation in terms of empowerment in communal farming groups.
- Success, scale out and impact are the results of a series of well planned research projects brought together over a decade. This research has been shaped by: long term commitment from ACIAR, Indonesian agencies and CSIRO; a participatory approach to engagement; a focus on understanding the system and its pressure and leverage points; commitment to building and realising critical capacity; and the inclusion of dedicated coordination effort, particularly for monitoring and evaluation.
- To benefit a significant number of smallholders, future research should move beyond local impact and contribute to the creation of a more favourable policy environment for farmers. Such research would address the potential to translate and transfer beneficial research outcomes into the Indonesian policy development process, with a focus on engagement with relevant institutions at different levels of government.

10References

10.1 References cited in report

Badan Pusat Statistik (2007, 2008). *Statistik Indonesia: Statistical yearbook of Indonesia 2007 and 2008*. Badan Pusat Statistik, Jakarta, Indonesia.

A Bamualim and RB Wirdahayati (2003). *Nutrition and management strategies to improve Bali cattle productivity in Nusa Tenggara*. In: Strategies to improve Bali cattle in eastern Indonesia; K Entwistle and DR Lindsay (eds); ACIAR Monograph Series No.110, Australian Centre for International Agricultural Research: Canberra.

SP Borgatti (2002). *Netdraw: Graph Visualization Software*. Harvard, Analytic Technologies.

Departemen Pertanian Republik Indonesia (2007). *Pedoman Percepatan Pencapaian Swasembada Daging Sapi (P2SDS)*.

Dahlanuddin, K Puspadi, M van Wensveen and C McDonald (2009). *Improving welfare and productivity of bali cattle in the collective housing system on Lombok, Indonesia*. Proceedings of the Knowing Animals conference, Florence, Italy, March 2009.

G Feder, RE Just and D Zilberman (1985). *Adoption of agricultural innovations in developing countries: a survey*. *Economic Development and Cultural Change* **33**(2): 255.

C Geertz (1975). *Common sense as a cultural system*. *The Antioch Review* **33**: 5-26

M Giampietro (2004). *Multi-scale integrated analysis of agroecosystems*. Florida, CRC Press.

B Koppel (1985). *Technology adoption among limited resource rice-farmers in Asia*. *Agricultural Administration* **20**(4): 201-223.

S Lisson, N MacLeod, C McDonald, J Corfield, L Wirajaswadi, R Rahman, S Bahar, N Razak, K Puspadi, Dahlanuddin, Y Sutaryono, R Padjung, S Saenong, L Hadiawati, Sahardi, Mashur, D Proptomo (2008). *Improving smallholder crop-livestock systems in eastern Indonesia*. ACIAR Final Report; Australian Centre for International Agricultural Research: Canberra.

S Lisson and J Corfield (2010). *Impact assessment of project related activities from ACIAR project AS2/2004/005 Improving smallholder crop-livestock systems in eastern Indonesia*. Unpublished report, January 2010.

S Mahanty (2002). *Conservation and development interventions as networks: The case of the India Ecodevelopment Project, Karnataka*. *World Development* **30**(8): 1369-1386.

G Martin (2010). *ACIAR investment in research on forages in Indonesia*. ACIAR Impact Assessment Series Report Number 65; Australian Centre for International Agricultural Research: Canberra.

I Patrick, G Marshall, I Ambarawati and M Abdurrahman (2010). *Social capital and cattle marketing chains in Bali and Lombok, Indonesia*. ACIAR Technical Reports Number 74; Australian Centre for International Agricultural Research: Canberra.

I Patrick (2004). *Contract farming in Indonesia: Smallholders and agribusiness working together*. ACIAR Technical Reports No. 54; Australian Centre for International Agricultural Research: Canberra.

I Patrick, G Marshall, M Abdurrahman and I Ambarawati (2006). *Determining the role of social capital in linking smallholders with agribusiness*. Proceedings of the Australian Agricultural and Resource Economic Society, Sydney, Australia, 8-10 February 2006.

C Talib, K Entwistle, A Siregar, S Budiarti-Turner, D Lindsay (2003). *Survey of population and production dynamics of Bali cattle and existing breeding programs in Indonesia*. In: Strategies to improve Bali cattle in eastern Indonesia; K Entwistle and DR Lindsay (eds); ACIAR Monograph Series No.110, Australian Centre for International Agricultural Research: Canberra.

N Uphoff (2005). Social capital and irrigation management: bringing rigor and evidence to the relationship. In Asian irrigation in transition: responding to challenges; G Shivakoti, D Vermillion, W-F Lam, E Ostram, U Pradhan and R Yoder (eds); Sage Publications India: New Delhi.

M van Wensveen, R Rachman, S Bahar, J Corfield, C Grunbuhel, S Lisson, Marsetyo, C McDonald, A Natsir, R Padjung, B Pengelly, M Salam and L Williams (2010). *Building capacity in the knowledge and adoption of Bali cattle improvement technology in South Sulawesi*. ACIAR Final Report; Australian Centre for International Agricultural Research: Canberra.

10.2 List of publications produced by project

J Corfield, Y Sutaryono, S Lisson, N MacLeod, L Wirajaswardi and C McDonald (2008). *The impacts of enhanced legume utilisation in the smallholder crop-livestock farming systems of eastern Indonesia*; Proceeding of 13th Animal Science Congress, Asian Australasian Animal Production Societies, Hanoi 22-26 September 2008.

Dahlanuddin (2008). *Model of acceleration of Bali cattle breeding in farmer groups in Lombok*; Proceedings of the National seminar on beef cattle development to support national beef self sufficiency program, Palu, Indonesia, 24 November 2008.

Dahlanuddin, K Puspadi, SP Quigley and JP Corfield (2008). *Herd management and feeding strategies to increase calf crop and post weaning growth rate of Bali cattle in eastern Indonesia*; Proceedings of national seminar on improving Bali cattle production under village rearing systems in eastern Indonesia; at Kupang, 19 November 2008.

Dahlanuddin (2009). *Bali cattle productivity improvement strategies in intensive farming systems: experiences in central Lombok, Nusa Tenggara Barat*; In Developing a sustainable smallholder Bali cattle production system in eastern Indonesia; Dahlanuddin, C McDonald and M van Wensveen (editors); ACIAR Monograph.

Dahlanuddin, K Puspadi, M van Wensveen and C McDonald (2009). *Improving welfare and productivity of Bali cattle in the collective housing system on Lombok, Indonesia*; Proceedings of the Knowing Animals conference, Florence, Italy, March 2009.

C Grunbuhel and L Williams (2010). *Food security or asset security: Farming systems interventions and impacts on livelihoods in eastern Indonesia*. Proceedings of Fifth Viennese Conference on Southeast Asian Studies: Human security in Southeast Asia, Vienna, Austria, 28-29 May 2010.

S Lisson (2009). *Development of a participatory, farming systems approach to improving Bali cattle production in the smallholder crop-livestock systems of eastern Indonesia*; In Developing a sustainable smallholder Bali cattle production system in eastern Indonesia; Dahlanuddin, C McDonald and M van Wensveen (editors); ACIAR Monograph.

S Lisson and J Corfield (2010). *Impact assessment of project related activities from ACIAR project AS2/2004/005: Improving smallholder crop-livestock systems in eastern Indonesia*. Unpublished report.

S Lisson, N MacLeod, C McDonald, J Corfield, B Pengelly, L Wirajaswadi, R Rahman, S Bahar, R Padjung, N Razak, K Puspadi, Dahlanuddin, Y Sutaryono, S Saenong, T Panjaitan, L Hadiawati, A Ash and L Brennan (2010). *A participatory, farming systems*

approach to improving Bali cattle production in the smallholder crop–livestock systems of Eastern Indonesia; *Agricultural Systems* (2010), 103, 486-497.

N MacLeod, S Lisson, C McDonald, J Corfield, R Rachman and K Puspadi (2008). *Integration of smallholder crop-forage-livestock systems in South East Asia – an eastern Indonesian case study*; Proceedings of the IGC-IRC Congress, Hohhot, China, July 2008.

K Puspadi (2009). *Optimisation of complex institutions to develop a model kandang breeding industry on the island of Lombok*; In *Developing a sustainable smallholder Bali cattle production system in eastern Indonesia*; Dahlanuddin, C McDonald and M van Wensveen (editors); ACIAR Monograph.

Y Sutaryono (2009). *Provision of livestock feed in the maintenance of Bali cattle in central Lombok*; In *Developing a sustainable smallholder Bali cattle production system in eastern Indonesia*; Dahlanuddin, C McDonald and M van Wensveen (editors); ACIAR Monograph.

11 Appendixes

11.1 Appendix 1

Information for 36 kandang groups, including location, number of farmers and number of cattle

	Group name	Location (sub village, Village, Sub District)	No of farmers	Total no of cattle (no of cows)	Notes
1	Gembala Makmur	Pengembuk, Kelebu, Praya Tengah	13	40 (15)	First group
2	Jaya Gembala	Pengembuk, Kelebu, Praya Tengah	46	108 (50)	First group
3	Ingin Maju	Pengembuk, Kelebu, Praya Tengah	39	64 (33)	First group
4	Lancar Jaya	Pengembuk, Kelebu, Praya Tengah	25	52 (20)	First group
5	Ingin Sukses	Jeruju II, Kelebu, Praya Tengah	61	107 (43)	First group
6	Beriuk Girang	Batunyale 2, Batunyala, Praya Tengah	17	38 (14)	First group
7	Suka Maju	Bengkang, Sukaraja, Praya Timur	35	90 (45)	First group
8	Beriuk Coba	Mt Sager, Sukaraja, Praya Timur	43	97 (35)	First group
9	Beriuk Pade Girang	Tandek, Labulia, Jonggat	28	53 (19)	First group
10	Anugrah	Dasan Baru, Ubung, Jonggat	43	125 (65)	First group
11	Bareng Nikmat II	Montong Ubuq, Jelantik, Jonggat	42	61 (24)	First group
12	Gontoran	Gontoran, Batutulis, Jonggat	39	81 (23)	Second group
13	Pade Maju	Mengelok, Batujai, Praya Barat	24	49 (19)	Second group
14	Rejeki Nomplok	Sukadana, Kel. Gerantung, Praya Tengah	24	44 (17)	Second group
15	Laju Rame	Jeruju 2, Kelebu, Praya Tengah	30	64 (27)	Second group
16	Trasna	Paneguk, Bagu, Pringgarata	58	144 (69)	Second group
17	Tunggal Harapan	Tana Beaq Barat, Tana Beaq, Batukliang Utara	34	80 (35)	Second group
18	Sumber rezeki	Bunmudrak, Sukarara, Jonggat	35	89 (38)	Second group

19	Gerepek	Bt Nyale, Nyerot, Jonggat	29	51 (21)	Second group
20	Ngelentong II	Batu Santek, Beraim, Praya Tengah	33	56 (28)	Second group
21	Bina Sejahtera	Lelong, Kelebu, Praya Tengah	24	47 (23)	Second group
22	Sama Hati	Medas, Bagu, Pringgarata	21	34 (11)	Second group
23	Putri Bekekem	Nyangget, Sepakek, Pringgarata	42	90 (32)	Second group
24	Nidaurrahman	Bebie, Aikmual, Praya	17	35 (15)	Third group
25	Beriuk Maju	Setai, Lajut, Praya Tengah	30	70 (31)	Third group
26	Anjani Subur	Mertak Tombok, Mertak Tombok, Praya	40	78 (37)	Third group
27	Ingin Sukses2	Tibuk Buak, Jontlak, Praya Tengah	33	59 (26)	Third group
28	Wira Karya	Barabali, Batukliang, Batukliang	33	76 (37)	Third group
29	Beriuk Girang2	Beber, Beber, Batukliang	17	38 (15)	Third group
30	Ingin Jaya	Salam Sukur, Pringgarata, Pringgarata	21	35 (18)	Third group
31	Lm3 Kamarul Huda	Bagu, Bagu, Pringgarata	12	42 (19)	Third group
32	Bareng Anyong	Repoq Dasan Baru, Pringgarata, Pringgarata	30	53 (31)	Third group
33	KT2M	Menemeng, Bagu, Pringgarata	50	81 (47)	Third group
34	Embel Bao	Bun Cemen, Gemel, Jonggat	25	48 (12)	Third group
35	Beriuk Sadar	Tapon Barat, Ds. Bilebanti, Pringgarata	29	60 (14)	Third group
36	Ingin Maju2	Gelogor Mapong, Bunut Baok, Praya	22	31 (17)	Third group
	Total		1144	2370 (1025)	

11.2 Appendix 2

Benchmarking questionnaire

1. Location

- 1.1. Village
- 1.2. Sub village
- 1.3. Sub District
- 1.3. Date of interview
- 1.4 Interviewer

2. Group information

- 2.1. Group name
- 2.2. Number of members
- 2.3. Age of group
- 2.4 Total no of cattle – cows, heifers, bulls, young bulls, heifers

3. Respondent

- 3.1 Name
- 3.2 Sex
- 3.3 Age
- 3.4 Education (no education, elementary school not completed, elementary school completed, junior high school not completed, junior high school completed, senior high school not completed, senior high school completed, university graduate)
- 3.5. Experience in raising cattle (years, number of cattle managed)
- 3.6 Main job
- 3.7. Other jobs

4. Household profile

- 4.1 Number of persons in the family (including household head):
- 4.2 Number of males, females
- 4.3 Number of members below 15 years old; number of members 15-64 years old; number of members over 64 years old
- 4.3 No of members working on farm

4.4 No of members working off farm

4.5 No of jobless member

4.6 The highest education in the family

4.7 Main source of income (on-farm and off farm).

5. Land holding

5.1. Ownership status (own land, no land, leased land)

5.2 Area of land owned

5.3 Main crop planted

5.4 Plants on bunds (crops or forages)

6. Cattle ownership

6.1. Number of cattle owned and managed

Type	Owned (head)	Managed (head)	Managed by others(head)
Bull			
Cow			
Heifer			
Young bull			
Calf			

6.2 How many cattle used for ploughing

7. Cattle mating

7.1 Mating system (natural or AI)

7.2 Cows mated x months after calving.

7.2 Mating fee applied?

7.3 Amount of mating fee

7.4 Distance to bull for mating

7.5 Weaning age

7.6. Cow and calves fed the same diets?

8. Cattle marketing (last 2 years to current)

8.1 Number of cattle sold

8.2 Type sold

8.3 Price,

8.4 Reasons for selling

8.5 Age at sale

8.6 Sold to (local trader, outside trader, livestock market)

8.7. Number of cattle bought

8.8 Type bought

8.9 Price

8.10. Age

8.11 From whom

8.12 No of cattle died

8.13 Type that died

8.14 Cause of death

9. Production costs

9.1 Money spent last year for: medication

Money spent last year on transportation to collect feeds

10. Labor and gender

10.1 Responsibility in raising cattle.

S = all members; K = family head; I = wife; L = boys; P = girls; B = contract labor; LL = others

Activity	Person responsible	Activity	Person responsible
Collect feeds in dry season		Controlled mating	
Collect drinking water		Health care	
Taking cattle for grazing/ tethering		Deciding when to sell	
Taking water to cattle		Deciding who to sell to	
Taking cattle to water for drinking or washing		Spending money from cattle sales	

11. Constraints

11.1 Number of cattle can be fed

1.2 Main constraints

12. Collecting feeds

12.1 Maximum distance from home

12.2 Number of hours spent to collect feeds in dry season

12.3 Average number of days per month to do cut and carry feeds

12.4 Number of months collecting feeds from outside own village

11.3 Appendix 3

Notes from scale out session at 2009 joint Project Coordination Meeting in Lombok (Lombok group responses)

Key discussion points:

1. What factors are currently driving scale out?
2. What are the constraints to scale out so far?
3. How can we boost scale out?

Factors driving current scale out

- Evidence of success that can be seen by farmers
- Positive competition between groups
- Good perception of the ACIAR program
- Willingness (and motivation) to change
- Experience and foresight
- Intensive communication from farmer to farmer
- Field visit/ study tour from new farmer group to established project farmer group
- Increase in the number of project or champion farmers

Constraints to scale out

- Limited resources
- Farmers who keep their tradition or mindset
- Too dependent on external incentive
- Internal conflict within farmer group
- Farmers who adopt a wait-and-see attitude
- Resource availability
- Land ownership (some farmers don't have land)
- Less motivation
- Uncertainty around animal security (at provincial level)

Suggestions to boost scale out

- Information from farmers to farmers
- The role of society leaders
- Farmer field days
- Find the key person
- Establish centre to visit (eg nursery)
- Appropriate publications
- Government policy (central and regional levels)
- Easy access to information: need posters, leaflets, video, radio, newspaper, TV, internet and other networking.
- Need support for farmers to get extra capital (eg microfinance)

11.4 Appendix 4

Lombok Program Advisory Committee: summary of meeting notes November 07 to October 09

The role of the Program Advisory Committee (PAC) was agreed in November 2007 as to provide overall guidance and advice on the direction and relevance of the project. The PAC Terms of Reference were:

- To ensure that the project is meeting its goals
- To assist with communication to external agencies and networks
- To participate in project reviews, workshops and events when possible
- To provide advice to the project teams on changes, priorities, policies and opportunities in relevant Indonesian agencies and institutes
- To assist the project teams to integrate project activities and outputs to new regions or agencies

A summary of the main discussion topics for each PAC meeting follows.

Meeting 1 – 5 November 2007

No major discussion points

Meeting 2 – 24 July 2008

- High degree of satisfaction with the **progress of the project**. Achievements of the OGTs were commented on favourably.
- Increasing NTB's **cattle population** seen as a major challenge. In addition to increasing numbers, need effort on retaining productive animals and reducing exports.
- Enthusiasm for concept of NTB as a **breeding centre** for Sapi Bali, especially with expected increases in tourism and demands from other islands.
- Discussion about using the project as a base for **sustainability** of the work beyond the current project. General commitment towards longer term activities and collaboration, with proposition by Dinas to take over the work.
- The need for **strong collaboration** and regular communication was emphasised. Team advised to strengthen relationships with local government, farmer groups and the JICA team.
- **Farmer participation**, empowerment and independence seen as crucial for adoption and project success. Project approach appreciated as seen as simple, but with high impact.

Meeting 3 – 28 October 2008

- General approval and **support for the project approach** particularly the philosophy of working closely with the farming community rather than just providing dollars or structures.

- The importance of strong **collaboration and communication** repeated.
- Agreement on the need for an **exit strategy and sustainability more broadly**. Suggestions included: more active involvement of PPLs, influence local government policy, ongoing collaborative network
- Emphasis on the potential of NTB becoming the **livestock breeding province** of Indonesia, thereby realising the provincial government's vision, but without draining the province's breeding stock.

Meeting 4 – 26 February 2009

- Declaration by the provincial government that NTB will be the **Land of a Million Cattle**, with a task force established to plan for this vision. LMC initiative not just an agricultural research project, but also a community movement and needs support by district government activities and policies.
- Much discussion about how to **replicate and expand** 'the ACIAR model' to other districts (in Central Lombok and other parts of NTB) and institutes (primarily Dinas and BP4K).
- **Future roles for OGTs** discussed, acknowledging that they are highly skilled, motivated field staff. Suggestions include employment by LMC, livestock business and farmer trainers.
- Suggestion that the project provide assistance to **improve capacity** in staff of newly established BP4K, using PST and OGT for training.

Meeting 5 – 3 June 2009

- Agreement on the **importance of the extension services** in increasing livestock production in the project, along with appreciation of the work of OGTs and further discussion of their role post-project.
- Discussion on the **issue of cow selling**, with agreement that more study is needed (timing, location, reasons).
- Noted that project outputs are well aligned to **regional policy initiatives** such as the NTB's LMC initiative. Three key components for policy were suggested as bull management, improved kandang management and controlling slaughter of productive females
- **Workshop** was proposed to socialise project ideas to key stakeholders (eg Bupatis, provincial offices) and discuss how project outputs can be implemented into government programs.

Meeting 6 – 7 October 2009

- **Potential to increase cattle production** across two systems of NTB (carrying capacity 200.000; current population 75.000) but challenges include farmer education, cattle inbreeding of cattle, disease, lack of feed, large inter-calving intervals, slaughter of productive females and low birth rate.
- Further agreement that **collaboration and communication** between key regional players must continue irrespective of the project finish.

- **Importance of OGTs** to success of the project stressed and also the **value of assets** built during the project, particularly experienced kandang groups, bulls and good system of information exchange. Need to be maintained.
- Agreement that Central Lombok is in a good strategic position to be a **learning site** for the rest of NTB and nationally.
- Need discussed for an incentive system to **retain productive females**, including livestock identity cards to monitor cattle traffic between districts.

11.5 Appendix 5

List of infrastructure improvements to each project kandang (n=36)

	Kandang group	Sanitation improvements	Mating space improvements	Other improvements
1	Gembala Makmur		Mating & weaning pen	Entrance, guard station, weighing platform
2	Jaya Gembala		Mating pen, weaning pen	Weighing platform
3	Ingin Maju	Drainage, flooring	Mating pen, weaning pen	Entrance, weighing platform
4	Lancar Jaya	Drainage, flooring	Mating pen, weaning pen	Entrance, guard station, weighing platform
5	Ingin Sukses	Drainage	Mating pen, weaning pen	Entrance, weighing platform
6	Beriuk Girang	Drainage	Mating pen, weaning pen	Weighing platform
7	Suka Maju	Drainage, flooring	Mating pen, weaning pen	Entrance, weighing platform
8	Beriuk Coba	Drainage, flooring	Mating pen, weaning pen	Roofing, entrance, weighing platform
9	Beriuk Pade Girang		Mating pen, weaning pen	Roofing, fence, entrance, guard station
10	Anugrah	Drainage, flooring	Mating pen, weaning pen	Fence, entrance, weighing platform
11	Bareng Nikmat II	Drainage	Mating pen, weaning pen	Entrance, weighing platform
12	Gontoran	Drainage	Mating pen, weaning pen	Weighing platform
13	Pade Maju	Drainage	Mating pen, weaning pen	Entrance, weighing platform
14	Rejeki Nomplok	Drainage	Mating pen, weaning pen	Entrance, weighing platform
15	Laju Rame	Drainage, flooring	Mating pen, weaning pen	Entrance, weighing platform
16	Trasna	Drainage	Mating pen, weaning pen	Weighing platform
17	Tunggal Harapan	Drainage, flooring	Mating pen, weaning pen	Entrance, weighing platform
18	Sumber Rejeki		Mating pen, weaning pen	Weighing platform
19	Gerepek	Drainage	Mating pen, weaning pen	Weighing platform
20	Ngelentong II	Drainage	Mating pen, weaning pen	Entrance, guard station, weighing platform
21	Bina Sejahtera	Drainage	Mating pen, weaning pen	Entrance, weighing platform
22	Sama Hati	Drainage	Mating pen, weaning pen	Fence, weighing platform
23	Putri Bekekem	Drainage, flooring	Mating pen, weaning pen	Weighing platform

24	Nidaurrahman	Flooring	Mating pen, weaning pen	Weighing platform
25	Beriuk Maju	Drainage	Mating pen, weaning pen	Entrance, weighing platform
26	Anjani Subur	Drainage	Mating pen, weaning pen	Weighing platform
27	Ingin Sukses2	Drainage	Mating pen, weaning pen	Entrance, weighing platform
28	Wira Karya	Drainage	Mating pen, weaning pen	Weighing platform, weighing platform
29	Beriuk Girang2	Drainage, flooring	Mating pen, weaning pen	Weighing platform, weighing platform
30	Ingin Jaya	Drainage	Mating pen, weaning pen	Weighing platform, weighing platform
31	LM3 Kamarul Huda	Drainage	Mating pen, weaning pen	Weighing platform, weighing platform
32	Bareng Anyong		Mating pen, weaning pen	Guard station, weighing platform
33	KT2M	Drainage	Mating pen, weaning pen	Fence, weighing platform
34	Embel Bao	Drainage	Mating pen, weaning pen	Weighing platform
35	Beriuk Sadar	Drainage	Mating pen, weaning pen	Entrance, weighing platform
35	Beriuk Sadar	Drainage	Mating pen, weaning pen	Entrance, weighing platform
36	Ingin Maju2	Drainage, flooring	Mating pen, weaning Mating pen, weaning pen	Roofing, entrance, weighing platform, weighing platform

11.6 Appendix 6

Detailed information on birth weights, weaning weights, population dynamics and mating information

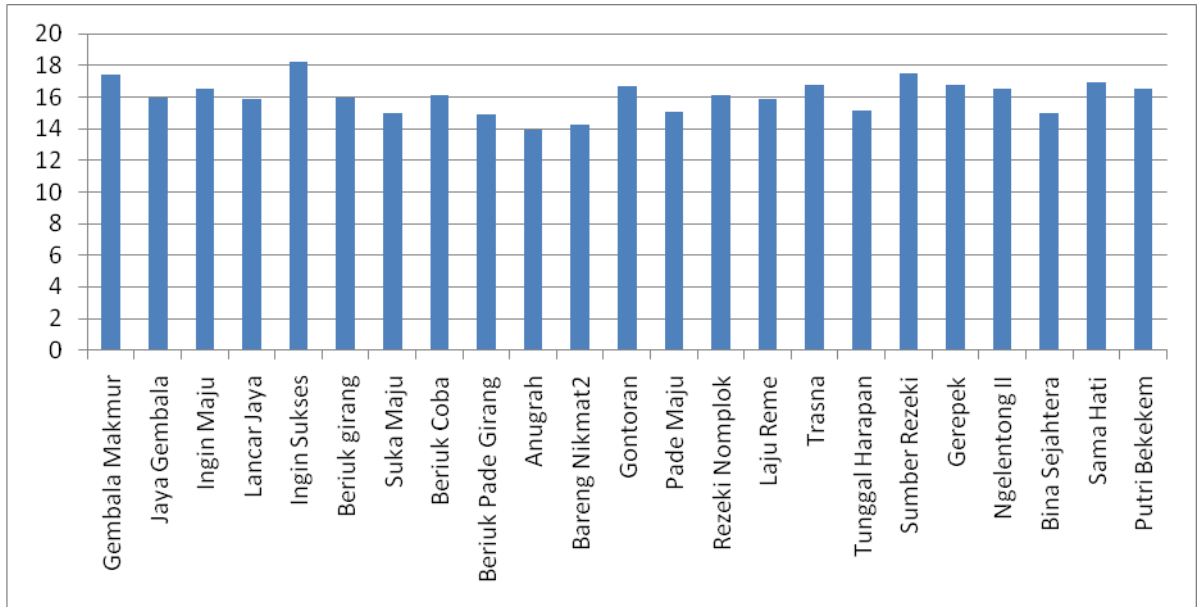


Figure A.6.1. Average birth weight (kg) of calves from each of the 23 kandangs in 2009.

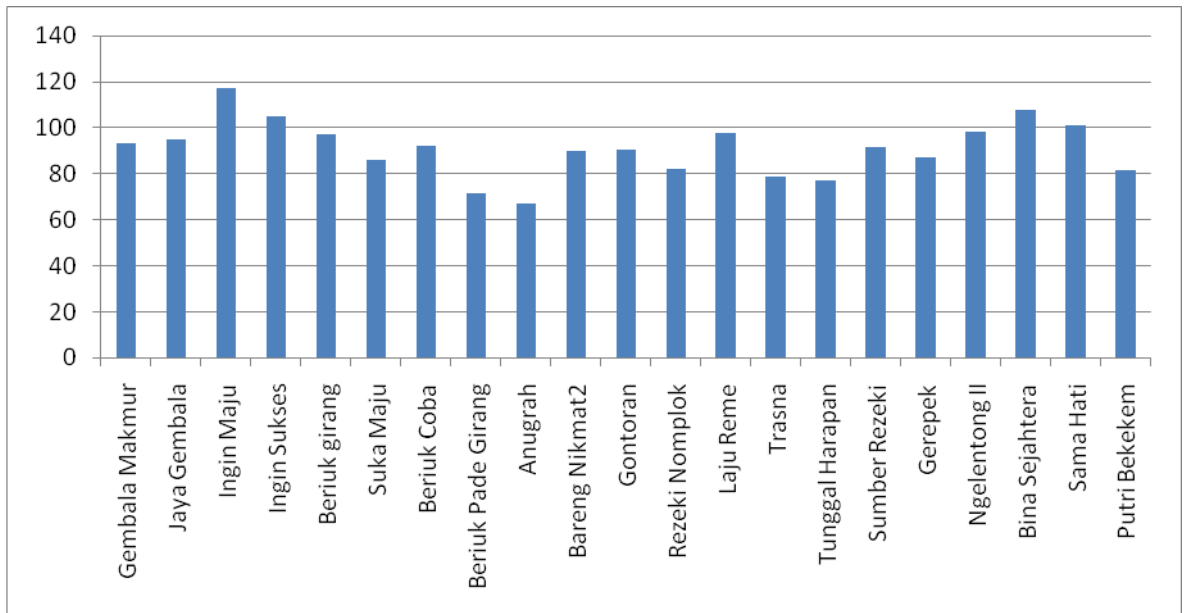


Figure A.6.2. Average weaning weight (kg) of calves from each of the 23 kandangs in 2009.

Table A.6.1. Herd dynamics data for the first 23 kandang groups over the 10 month period from August 2008 to October 2009.

Kandang group	Aug-08	New	Born	Sold	Moved	Died	Oct-09
Gembala makmur	37	4	19	17	0	3	40
Jaya Gembala	109	14	56	67	0	4	108
Ingin Maju	88	10	44	54	21	3	64
Lancar Jaya	71	32	8	53	5	1	52
Ingin sukses	109	19	57	57	20	1	107
BeriuK Girang	46	8	21	28	7	2	38
Suka Maju	74	21	36	31	7	3	90
BeriuK Coba	92	9	50	40	2	5	104
BeriuK Pade Girang	85	15	29	60	6	7	56
Anugrah	106	10	63	40	7	7	125
Bareng Nikmat II	75	10	22	37	3	6	61
Gontoran	79	30	16	41	3	0	81
Pade Maju	51	1	14	12	5	0	49
Rejeki Nomplok	33	10	19	14	3	1	44
Laju Reme	56	12	37	39	2	0	64
Trasna	127	1	61	29	6	10	144
Tunggal Harapan	69	5	24	17	0	1	80
Sumber Rejeki	106	10	32	44	5	10	89
Gerepek	36	15	23	20	1	2	51
Ngelentong II	60	28	12	36	5	3	56
Bina Sejahtera	54	13	25	34	7	4	47
Sama Hati	32	10	16	20	0	3	35
Putri Bekekem	76	10	33	25	2	2	90
Total	1671	297	717	815	117	78	1675

Table A.6.2. Herd dynamics data for the first 23 kandang groups from August 2008 to November 2010.

Kandang group	Aug-08	New	Born	Sold	Moved	Died	Nov-10
Gembala makmur	37	18	36	47	4	3	37
Jaya Gembala	109	19	103	103	6	7	115
Ingin Maju	88	18	76	66	22	3	91
Lancar Jaya	71	33	43	76	9	2	60
Ingin sukses	109	48	80	81	32	1	123
BeriuK Girang	46	18	37	47	9	3	42
Suka Maju	74	27	63	79	16	6	63
BeriuK Coba	92	17	87	75	6	5	110
BeriuK Pade Girang	85	20	46	80	11	9	51
Anugrah	106	16	109	79	13	10	129
Bareng Nikmat II	75	27	42	54	6	8	76
Gontoran	79	44	33	68	3	2	83
Pade Maju	51	3	28	23	12	3	44

Rejeki Nomplok	33	39	45	28	4	2	83
Laju Reme	56	20	58	53	7	1	73
Trasna	127	7	96	70	15	10	135
Tunggal Harapan	69	6	46	32	1	2	86
Sumber Rejeki	106	17	57	67	9	13	91
Gerepek	36	21	41	34	2	6	56
Ngelentong II	60	29	35	49	5	6	64
Bina Sejahtera	54	22	46	36	9	5	72
Sama Hati	32	13	20	34	1	3	27
Putri Bekekem	76	12	54	38	2	5	97
Total	1671	494	1281	1319	204	115	1808

Table A.6.3. Number of cows mated in each kandang group in 2008 and 2009.

Kandang group	2008			2009		
	Group	Satellite	Total	Group	Satellite	Total
Gembala Makmur	18	5	23	12	10	22
Jaya Gembala	53	4	57	53	7	60
Ingin Maju	27	21	48	34	69	103
Lancar Jaya	23	12	35	23	18	41
Ingin Sukses	43	15	58	48	14	62
Beriuk Girang	18	84	102	18	47	65
Suka Maju	32	37	69	37	25	62
Beriuk Coba	39	9	48	41	9	50
Pade Girang	25	24	49	26	36	62
Anugrah	55	42	97	55	37	92
Bareng Nikmat 2	15	4	19	24	12	36
Gontoran	17	0	17	22	0	22
Pade Maju	12	10	22	13	11	24
Rejeki Nomplok	15	69	84	23	68	91
Laju Reme	29	21	50	28	10	38
Trasna	39	6	45	49	6	55
Tunggal Harapan	24	3	27	24	4	28
Sumber Rejeki	30	0	30	29	0	29
Grepek	21	4	25	23	0	23
Ngelentong II	30	30	60	26	49	75
Bina Sejahtera	20	15	35	17	25	42
Sama Hati	8	1	9	13	4	17
Putri Bekekem	24	28	52	30	34	64
Nidaurrahman				10	20	30
Beriuk Maju				34	22	56

Anjani Subur				36	74	110
Ingin Sukses 2				26	19	45
Wira Karya				24	34	58
Beriuk Girang 2				12	39	51
Ingin Jaya				8	9	17
Qomarul Huda				8	1	9
Bareng Anyong				20	17	37
KT2M				20	0	20
Embel Bao				11	12	23
Beriuk Sadar				21	0	21
Ingin Maju 2				14	26	40
Total (1-23)	617	444	1061	668	495	1163
% (1-23)	58.2	41.8		57.4	42.6	
Total (25-37)				244	273	517
% (25-37)				47.2	52.8	
Total (1-37)				912	768	1680
% (1-37)				54.3	45.7	

11.7 Appendix 7

OGT and PST feedback on changes to farmer capacity, farming systems and social systems in the study communities as a result of participating in the project

Table A.7.1. Project Specialist Team perceptions of significant changes to farmers as a result of participation in the project (summary of responses from Lombok and Sulawesi PST in May 2010)

Significant changes to farmer knowledge & skills	Significant changes to farming system	Significant changes to individual or community
<p>Technical skills</p> <ul style="list-style-type: none"> Planting and using forages Animal nutrition Early weaning Forage conservation for dry season Breeding management Organic fertiliser production Feed budgeting Animal health 	<p>Productivity outcomes</p> <ul style="list-style-type: none"> Reduced calving interval Reduced calf mortality Increased cow condition Increased income Increased growth rate of young animals Increased cattle numbers (more feed) results in increased cash flow Increased birth weight Amount & quality of year-round forage increased Greater diversity of forage 	<p>Individual changes</p> <ul style="list-style-type: none"> Increased confidence and pride Better interactions with other farmers Increased communication Increased status in community Attitude toward technology package changed
<p>Understanding causal links</p> <ul style="list-style-type: none"> Quality bull → quality calves Preferential feeding pregnant cows → improved birth weight Early weaning reduces calving interval Controlled mating does not have negative effect on calves Early weaning → calf growth Crop residues help address feed shortage 	<p>Land use & labour</p> <ul style="list-style-type: none"> More efficient use of spare land Non farm work decreased because better income from farming Change in crop-livestock balance Time and labour efficiency Increased land devoted to forage Decreased labour required for cattle management 	<p>Community changes</p> <ul style="list-style-type: none"> Sharing information & resources Increased communication Increased collaboration
	<p>Changed practices</p> <ul style="list-style-type: none"> Increased bull mating ratio Kandang sanitation – inside and outside Use of compost as fertiliser Tree legumes valued as feed source 	

Table A.7.2. On Ground Team perceptions of significant changes to farmers as a result of participation in the project (summary of responses from Lombok and Sulawesi OGTs in May and June 2010)

	Significant changes to farmer knowledge & skills	Significant changes to farming system	Significant changes to individual or community
Combined#	<p>Enhanced technical skills:</p> <ul style="list-style-type: none"> • feed budgeting, management, transport, preferential feeding • cattle management and breeding 	<p>Vacant land now actively planted with forages</p> <p>Chemical fertiliser being replaced by organic fertiliser</p> <p>Farmer income increased</p> <p>Change in feed management</p> <p>Change in animal management</p> <p>Orientation of farmers changed from cattle holding to breeding</p> <p>Greater efficiency of time and labour</p> <p>Change from extensive to intensive management</p>	<p>More collaborative attitude</p> <p>Greater involvement of wife and children</p> <p>More self awareness</p> <p>Greater communication</p> <p>Farmers more business oriented</p> <p>Greater time efficiency</p> <p>More time to find side business</p>
Lombok*	<p>Increased capacity in managing bull, controlled mating, early weaning and better feeding</p> <p>Better cattle and farm management skills</p> <p>Better understanding of cause and effect</p> <p>Better problem solving abilities</p>	<p>Forages planted on bunds and spare land; some farmers now using padi or land for cash crops for forages</p> <p>Selling cows at 12 months as better feeding gives same price as 18 months previously</p> <p>Reduction in time for gathering forage</p> <p>Change in attitude from using cattle for emergency capital to regular income source</p> <p>Now buying Bali cattle rather than cross breeds</p> <p>Change from cattle fattening to breeding and selling weaned calves</p> <p>New forage options</p>	<p>Increased cooperation to improve kandang</p> <p>Helping other farmers when sick or away</p> <p>Higher income from cattle in better condition</p> <p>Increased income used to buy motorbikes for forage collection and transport to off-farm work</p> <p>Greater confidence</p> <p>Seeing opportunity to stay in village and make money from cattle (rather than going to cities or abroad for work)</p> <p>Now working things out themselves rather than just following OGT advice</p> <p>Some kandangs raising funds to invest in a second kandang</p>

Feedback from Sulawesi and Lombok OGTs at final Project Meeting in Bali in May 2010 (Williams, van Wensveen)

* Additional information collected from OGT groups during final field visit in June 2010 (McDonald, Corfield)

11.8 Appendix 8

Comparison of production before and after introducing project activities

Indicator	Before	After	Comment
Number of cows	100	100	
Conception rate (%)	68.9	89.6	Increased conception rate due to cows in better condition and bull access
Potential number calves in 5 years	345	448	
Inter-calving interval (months)	16	12.4	Seasonal mating
Actual number of calves in 5 years	258	434	This assumes a calving rate of 51.7% before and 86.7% for the project and is a combination of conception rate and inter-calving interval
Still births (%)	1	1	
Actual live births in 5 years	256	429	
Mortality rate to weaning (%)	15	6.2	Better nutrition and hygiene
Calves weaned in 5 years	218	402	
Average birth weight (kg)	12.7	16.0	
Growth rate of calves (kg/day)	0.25	0.35	Better nutrition
Weight at 12 months (kg)	104	144	
Liveweight sold over 5 years (kg)	22661	57788	Total LWT of animals sold
Price (Rp/kg liveweight)	23000	25000	Better price assumed for 'After' animals because they are in better condition
Value to farmers (Rp Million)	521	1445	
Potential benefits			
% increase in animal turnoff		84	
% increase in beef production		155	
% increase in farmer revenue		177	

Notes

- 1 'Before' indicators taken from Talib's 2003 survey.
2. Calculations assume 100 cows in kandang and compares production over 5 years