

# Managing Sustainable Practice Changes in A Low Input Bali Cattle Production System in West Sumbawa

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**Abstract:** Bali cattle enterprise in Eastern Indonesia is characterized by low productivity and small holder farming system that rely heavily on natural resource for feed. Although innovations of improved forage and feeding management are available, Sumbawanese farmers still practice extensive traditional feeding system. This paper discusses approach and strategies applied to manage change on farmers' practices in a low input cattle production system aiming for higher productivity and profitability. An action research study was conducted in Sumbawa between 2010-2014 to assess contribution of approaches, methods and strategies towards farmers' practice changes. The research was entwined in an adaptive research project entitled '*improving forage tree legume management for cattle fattening in Eastern Indonesia*'. The study has shown that a combination of methods and strategies developed from the results of a community based situation analysis was effective to manage farmers towards practice changes. These methods included rising self awareness, adaptive trial, increasing knowledge and skills and providing access to inputs. The practice changes can be seen by farmers started implementing the introduced innovations including planting improved feed *Leucaena sp.* and improved cattle management. These changed practices subsequently have improved the cattle productivity which has provided increased return for farmers. This paper concludes that more intensive stakeholder participation in planning processes resulted in a greater sense of ownership over achievements, followed by faster, more sustainable and self-motivated practice change. Sustainable practice change is likely to lead to higher agricultural productivity, in turn enhancing farmers' livelihoods.

**Keywords:** traditional system, participation, adaptive trial, dry land.

## Introduction

Low productivity of Bali cattle production system in Eastern Indonesia has been recorded in a number of studies (see Wirdahayati and Bamualim, 1990 cited in Mastika, 2002; Bamualim and Wirdahayati, 2002; Dahlanuddin et al., 2009). The cattle enterprise is characterized by integrated crop-livestock small holder farming system, rely heavily on natural resource for feed, and frequently manage under a low-input management system (Talib et al., 2002). In the existing system in Sumbawa, cattle are managed under extensive system in which the animals are left to freely graze native grass in common areas such as road sides, hills, forest, and commune areas. During crop season, the cattle graze native grasses while after crop harvest, mainly maize, cattle are put in the farm land to eat maize stalk. Ironically, high quality feed such as forage tree legume *Leucaena leucocephala* are available throughout the year. This forage tree legume are used as fence around the farm land.

Although innovations are available to increase the productivity of Bali Cattle enterprise such as improved forage and feeding management, Sumbawanese farmers still practice extensive traditional feeding system. Instead of utilizing the *Leucaena leucocephala* farmers prefer to put their cattle in the maize stalk. One reason mentioned was that feeding *Leucaena* is not a common practice. Moreover, did not have much information on *Leucaena* as high quality feed. This paper discusses approach and strategies tested to manage change on farmers' feeding practice in a low input cattle production system for higher productivity and profitability.

## Methodology

An action research approach (Stringer, 1996) was conducted in Sumbawa between 2010-2014 to assess contribution of approaches, methods and strategies implemented in an adaptive research project towards farmers' practice changes. This action research was entwined with a research project entitled "*Improving Cattle Fattening Systems Based on Forage Tree Legume (FTL) Diets in Eastern Indonesia and Northern Australia*".

This initiative is a collaborative project between the Australia Centre for International Agricultural Research (ACIAR), the West Nusa Tenggara Assessment Institute for Agricultural Technology and the University of Mataram. The innovation contents in the project included technical aspect of utilizing FTL *Leucaena leucocephala* for fattening and improved management; and social community aspect of group development. The project has been operating from 2010 to 2015. Two project sites, Senayan and Seteluk villages were used as study case for this paper. In the two sites, farmers own five cattle and one hectare land in average. Qualitative and quantitative data were collected through direct observation, focus group discussion and in-depth interviews using several participatory techniques (Bryman, 2004; Chambers, 1994; Marshall & Rossman, 2006). For quantitative data, data were tabulated and analyzed descriptively. While for qualitative data, data were analyzed using phenomenological thematic analysis (Patton, 1987). Data collection was on the projects' approach and methods, farmers' existing practices and the processes of the changed practices, farmers' participation during project's operation, results of changed practices on Bali cattle performance and project's achievements on farmers' livelihood.

## Results and Discussion

### Operationalization of the Forage Tree Legume (FTL) Project

The FTL project holds on participatory approach as an underpinning principle which was then reflected in the project's operation. At the same time, one of the project's objectives is to improve cattle productivity, particularly for fattening enterprise, by utilizing the forage tree legume *Leucaena leucocephala*. As the implementation of the participatory approach, the project was started by a community based situation analysis aimed to build understanding on farmers' existing practices, situations, problems, needs and opportunities as well as to seek feasible interventions to improve the problems of low cattle productivity in the sites. Results of the situation analysis were used to develop the project's methods and strategies to manage towards farmers' practice change. These methods and strategies are shown in Figure 1 and will be discussed further in the paper.

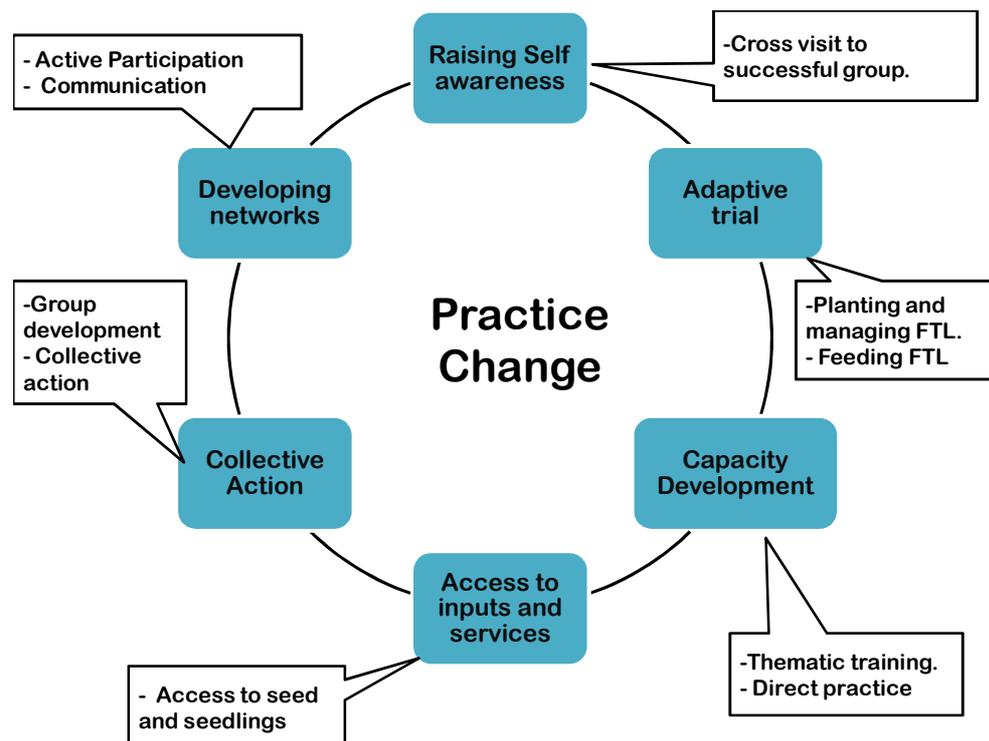


Figure 1: A framework to manage farmers' practice change

### Managing Farmer's Practice Change

The FTL project employed a number of methods to manage farmers' practice change. These methods targeted development of farmers' critical skills in making decision for higher productivity of cattle enterprise as discussed below.

### **1. Raising self-awareness**

In the FTL project, raising self-awareness was considered as the foundation for farmers' practice change. To be able to change, farmers need to be aware of their situations, problems and then need to be shown possible options to solve their problems. Cross visit to a more advanced group was a method employed to raise farmers' awareness on their low cattle productivity. Farmers from Senayan and Seteluk were taken to visit a group in Jatisari, Sumbawa. Farmers in Jatisari are Balinese trans-migrants that have used *Leucaena leucocephala* for cattle fattening. This practice was brought from their hometown in Bali. Farmers in Jatisari already plant this FTL by purpose in their farm, some farmers combine it with cash crops such as peanuts and corns in the alley, others plant it solely. One of the Jatisari farmers, Wayan Budiasa reported that by two hectare *Leucaena leucocephala* farm, he can fatten 11-12 bulls during rainy season and 6-7 bulls during dry season with 4-6 months fattening period. Another woman farmer, Mangku Sandiasa manage to fatten around 11-12 bulls throughout the year with her only one hectare *Leucaena leucocephala* farm. This single parent said that she also bought *Leucaena leucocephala* from other farmers to fulfill the bulls' need.

During the cross visit, farmers from Senayan and Seteluk were facilitated to discuss and exchange experience with Jatisari farmers. Some new information they got from the Jatisari visit including *Leucaena leucocephala* farm management such as row spacing, density, harvesting, biomass production, amount offered to bulls and managing farmer group. According to the Senayan and Seteluk farmers, the cross visit was very inspiring because it was the first time they witness cattle eat *Leucaena leucocephala* as single diet. They also impressed with the cattle body condition scores in comparison to their cattle in Senayan and Seteluk. The visiting farmers admitted that before the visit, *Leucaena leucocephala* as cattle feed did not exist in their perspective. The visit to Jatisari has opened their mind and convinced them the benefits of *Leucaena leucocephala* for cattle fattening.

### **2. Adaptive trial**

The second method employed to achieve farmers' practice change was adaptive trial to test and adjust the introduced innovations based on local conditions. Instead of only showing the innovations in the demonstration plot, farmers were asked to practice the introduced innovation in their own land and cattle enterprise. There were two adaptive trials for partner farmers in Senayan and Seteluk, planting and feeding *Leucaena leucocephala*. During the adaptive trial, partner farmers were given technical assistance on planting *Leucaena leucocephala* and feeding it. Along with the project's field researchers, farmers practiced steps on planting this FTL including seedling, nursing, transplanting, and FTL management. Meanwhile, feeding trial included amount offered and FTL composition.

The adaptive trials allowed farmers to adjust the implementation of the introduced innovations based on the local conditions. As an example, for seedling, the projects research has shown that using planting bag has produced the best seedlings compared to direct planting or raised bed. Yet, farmers were allowed to select whichever methods that suit their conditions. Due to their economic constraints, a number of farmers even replaced the planting bag by used mineral water cup.

### **3. Farmers' capacity development**

The project perceives that to change, farmers also need the capacity to make analysis and decision on changing practices. Therefore, this project place farmers' capacity development an important role in managing farmers' practice change. The adaptive trials were part of the project's effort to improve farmers' capacity which is expected to lead to farmers' practice change. The adaptive trials were run using thematic training method. Instead of giving farmers a package of technology, the project provided training and assistance thematically based on the stage of trial and their needs. It was expected that farmers would have time and space to understand and internalize the introduced innovation, hence practice them voluntarily. Examples of themes for training include steps for planting *Leucaena leucocephala* such as seedling, nursery, transplanting, nurturing, harvesting; feed composition; cattle weighing; and health management. The adaptive trials provide farmers skills and opportunity to experience how to implement the introduced innovations, efforts needed and the consequences. Therefore, it is expected that when the project has finished, farmers can run it self-sufficiently.

### **4. Strengthening access to inputs and services**

The FTL project is aware that practice change in a research for development initiatives often ceased because of the farmers' inability to access the required inputs. Learning from other projects' experience, the FTL project provided access to the required inputs to support the sustained practice changes. This input was improved variety seeds of *Leucaena leucocephala* in which farmers will be able to reproduce them in the future. Therefore, farmers will not depend on external factor to implement the introduced innovations.

## 5. Group collective action

Principally, the FTL project worked collaboratively with farmers on group bases. However, due to dynamics in the field, the project applied different approach for project operation in Senayan and Seteluk. In Senayan village, the project used group approach that involves 25 farmers of Senap Semu farmer group. When the project began, all of the farmers managed breeding cattle under extensive system. In the first year of the project operation, only 8 out of the 25 farmers put their cattle in the pen and fed by native grass, rice and maize straw. By contrast, the project selected individual approach to farmers in Seteluk because of the perpetual challenges working with farmers in group. Among those challenges were unequal job sharing leading to group member withdrawal and farmers' hesitance for group work.

## 6. Strengthening network

The FTL project considered that developing network is one of the key elements for scaling out the implementation of the introduced innovations. For this reason, the project facilitated all stakeholders' involvement in the project's processes to provide opportunities for network building. Moreover, the project established communication platforms among stakeholders such as purposive, reflective and regular meetings.

### Challenges for Farmers' Practice Change

Initially, when the project introduced to plant *Leucaena leucocephala* as cattle feed and put the cattle in the pen in Senayan and Seteluk, majority of farmers resisted these innovations. These practices are not common. Planting forages does not exist anywhere in their perspective; forages should be provided by nature. Meanwhile, fattening enterprise would require more intensive housing system in which farmers will need to cut-and-carry the feed. Most Sumbawane farmers consider that searching and carrying feed, particularly on the shoulder is as an activity of people from low social strata. Therefore, they would prefer to leave their cattle in the maize stalk than to collect and carry feed. As a result, only two out of 25 farmers in Senayan group attempted to feed *Leucaena* and switched into more intensive fattening enterprise. While only one farmer was interested in Seteluk.

### Overcoming the Challenges

The project applied several methods and strategies to overcome challenges for farmers' practice changes. These strategies refer to the project's framework including: (1) *cross visit* to Jatisari, a more established group practicing fattening enterprise using *Leucaena*. During the cross visit, farmers from both sides were facilitated to discuss and compare their cattle management system, the superiorities and the drawbacks. (2) *Cattle weighing* by farmers every month to see cattle growth fed by *Leucaena*. (3) *Adaptive planting trial* of *Leucaena leucocephala* in farmers' land. The project provided seeds of improved variety *Laecaena leucocephala* more resistant to psyllids as well as assistance on seedling and nursery. (4) *Thematic training* to build farmers' understanding on the introduced innovations and the benefits for farmers. (5) *Facilitating active involvement* of all group members in every stage of the projects by providing equal opportunities to participate and contribute to project's activities.

### Project's Achievements

#### *Farmers' capacity development*

Interviewed farmers reported to have improved knowledge and skills after participating in the forage tree legume. These improved knowledge and skills are mainly on cattle management and on feeding management. Before the project started, the farmers were not aware that *Leucaena* is a high quality feed for cattle. The *Leucaena* was even given away to migrant farmers such as Balinese and Sasaknese. Now the Sumbawane started to feed *Leucaena* for cattle and witnessed positive effects of feeding *Leucaena* on cattle performance.

#### *Stronger bargaining position in selling cattle*

One of the FTL project's activity was cattle weighing that farmers could see changes on the cattle weight from *Leucaena* feed. By knowing the cattle weigh, now the farmers also gained stronger bargaining position for selling price. Before the project, cattle selling prices were determined by traders in which farmers had limited power to bargain. After cattle regular weighing, now farmers have data on their cattle weight as a reference to predict and bargain their selling prices. Figure 3 shows the average monthly profit farmers gained from selling fattened cattle which accounted for Rp. 1,500,000 per head.

#### *Farmers planting and feeding Leucaena*

The cattle weighing activity provided comparative results of cattle weights fed by *Leucaena* and native grass. This has convinced more farmers in Senayan group and outside the group to plant and use *Leucaena* for cattle. Now seven farmers in the group have planted four hectare land while farmers outside the group have planted nine hectares. While in Seteluk, due to challenges as has been mentioned earlier, two people have practiced

feeding *Leucaena*. Nonetheless, these two people have attracted others to visit the trial site and vowed to plant and feed *Leucaena*.

### Improved cattle growth

As a result of feeding *Leucaena*, cattle in Senayan have depicted an improved daily weight gain as shown in the Figure 2. Figure 2 shows that the highest average life weigh gain for cattle fed by *Leucaena* in Senayan was on September which accounted 0,6 kg/head/day. This figure is higher compared to Bali cattle average daily weight gain fed native grass that accounts for 0.05-0.1 kg/day during dry season and 0.2-0.4 kg/day during rainy season (Bahar and Rakhmat, 2003, cited in Chamdi, 2005). Additionally, September is a dry month in West Sumbawa, yet the cattle fed by *Leucaena* in Senayan were able to achieve a high daily weight gain as compared to those fed by native grasses. Meanwhile, figure for Seteluk is not presented here as farmers just started fattening cattle by feeding *Leucaena leucocephala* at the time data were taken.

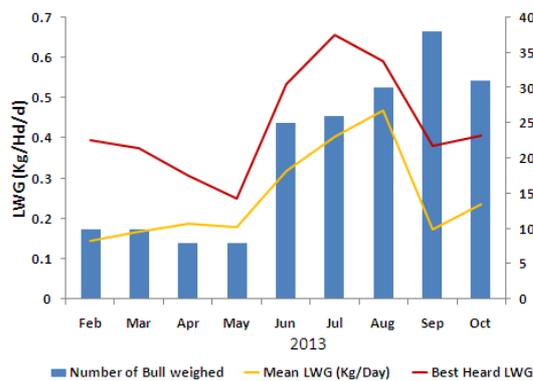


Figure 2: Bali cattle performance in Senayan fed by *Leucaena*

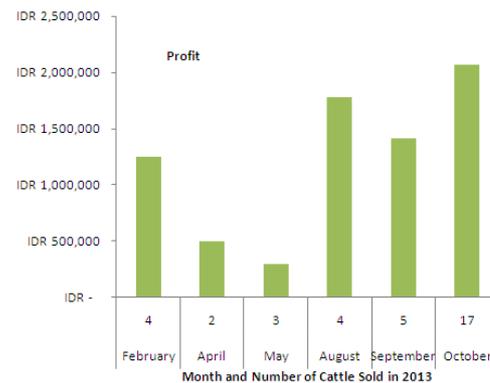


Figure 3: Monthly mean profit of all cattle sold in Senayan

## Discussion

Two broad traditions appear to exist in agricultural research and development initiatives. First is the 'quantitative tradition' where the return on investment in terms of project input versus output (i.e. adoption) become the focal interest; and second is the 'process tradition' where processes to achieve impact become the main project interest (Hall, et al., 2001). These two traditions will influence a project design and operation. Referring to these two categories, the forage tree legume project put more attention on pathways to achieve impacts rather than merely extracting scientific data from farmers. This is reflected by the implementation of the participatory approach as underpinning principle. At practical level, this principle was enacted in the form of community based situation analysis as a foundation to develop framework for the project operation.

Farmers' practice change is a complex processes in which a research for development project needs a comprehensive framework to manage towards changes. This study has shown that a combination of methods and strategies developed from the community based situation analysis was effective to manage farmers towards practice changes. Farmers admitted that the cross visit has raised their awareness on the use of *Leucaena leucocephala* for fattening cattle that previously they neglected. This awareness was then strengthened by the trials in which farmers became convinced and confidence to practice the introduced technology. This confidence was then supported by thematic training that enhanced farmers' capacity on technical areas and analytical skills in making decision. The FTL project has shown that farmers' involvement in problem definition can motivate people to participate in solving the problem reduce resistance to the introduced innovations (Chambers, 1994b; Petheram, 2000).

The combination of methods applied in the FTL project has shown to serve as building blocks to reach farmers' practice change. Results from this study are in line with other works using participatory approach. Gerrits et al, 1996 reported that innovations are more likely to be implemented when they address the priority problems and needs of farmers' day-to-day life. In the FTL project, the community based situation analysis provided opportunity for farmers to identify their priority problems to be solved in regards to cattle enterprise. It is farmers who can determine important problems to be solved in their daily life, compared to researchers, a majority of whom living in urban areas, rarely practicing agriculture and often approaching farmer's problems from a

researcher's perspective (Hoffmann et al., 2007). Based on these priority problems, farmers in collaboration with the project then determined agenda and activities to be undertaken. Results of these processes can be seen in partner farmers changed practices. They implemented the introduced innovations voluntarily. The achievement of farmers' practice changes in the FTL project strengthened a claim that farmers' practice changes is more likely to happen when they have a sense of belonging to the problem and the solution (Petheram, 2000).

The FTL project has also shown that farmers' active involvement throughout the project's processes created a sense of ownership over the project's activities which then contributed to farmers' voluntary practice changes. These changes are shown by implementation of the introduced innovations. This evidence again has confirmed that providing space for farmers' active involvement will enable wider and sustainable implementation of the introduced innovations (Chambers & Ghildyal, 1985; Maurya, 1989; Hilmiati, 2013). Similarly, van de Fliert and Braun (2002) proposed that farmers' involvement starting from the need and opportunity assessment, enable them to gain understanding the context of the research. This understanding then allows farmers to internalize the introduced innovations into their existing farming practices as learning processes for the technology to be adapted to suit local conditions (van de Fliert and Braun, 2002). In the FTL project, farmers' experienced that the project activities were to solve their problems defined earlier in which this process has convinced them to change practices.

Another key for farmer practice change in the FTL project was the approach of facilitating experts and farmer's adaptive testing. It was observed that researchers in the project played a role as facilitator and learning partner rather than teacher for farmers. This approach was seen to encourage farmers trying and adapting the introduced innovation based on their social and economic conditions. Interviewed farmers reported that the cross visit and learning trial has convinced them the benefits of the introduced innovation, hence practice them. In agreement with van de Fliert and Braun (2002), this study found that farmers' adaptation to the introduced innovation to meet their needs and conditions produces a local-specific innovation that have a greater likelihood to be implemented. Higher level of farmer's participation leads to outcomes that are closely suited to farmers' needs (Chambers, 1994b; Petheram, 2000).

## Conclusions

Smallholder farmers usually experience a complex life that will influence their decision in livestock management. Required inputs, labor availability and social-cultural conditions are among factors influencing farmers' decision in selecting their practices. Therefore, innovation intervention will need to consider these circumstances for higher innovation acceptance and implementation. This study shows that farmers' involvement in determining and evaluating solutions to their problems through taking part in the project processes corresponds to ownership and commitment over the processes. This active involvement contributes greatly towards more suitable outputs and self-motivated practice change. This self-motivated practice change provides greater opportunity for more sustainable impacts on farmer's livelihood.

This paper concludes that more intensive stakeholder participation in planning processes resulted in a greater sense of ownership over achievements, followed by faster, more sustainable and self-motivated practice change. Sustainable practice change is likely to lead to higher agricultural productivity, in turn enhancing farmers' livelihoods.

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