Chapter 6

TRANSFORMATION OF SMALLHOLDER BEEF-CATTLE PRODUCTION IN VIETNAM[1]

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Introduction

This chapter addresses the question "Can smallholder livestock production systems in developing countries be transformed to take advantage of the increasing demand for meat?", a question that has been posed by many authors (for example, Tarawali et al. 2011). On the basis of a case study that followed smallholder cattle development in Ea Kar, a district in the central highlands of Vietnam, over a ten-year period, it analyzes the contributions to sustainable intensification of smallholder livestock production made by technology interventions, market linkages, private-sector development, participatory research and farmer group-based approaches, capacity strengthening, local coalitions, and innovation platforms.

Livestock production is considered to be an important pathway out of poverty for the rural poor in developing countries (for example, Kristjanson et al. 2010) and worldwide 1 billion poor people depend on livestock for their livelihoods (McDermott et al. 2010). Livestock are living assets contributing to nutrition, food security, and building wealth. The increasing consumption of meat in some developing countries, related to rising household income and rapid urbanization, has been well documented (for example, Delgado 2003). In Vietnam, per capita meat consumption rose at an average annual growth rate of 4.1 percent from 11 kg in 1980–1982 to 28 kg in 2001–2003, confirming Vietnam as one of the developing countries where the predicted "livestock revolution" is taking place (Pica-Ciamarra and Otte 2011). While much of this increase can be attributed to increased consumption of pork,

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consumption of beef has been predicted to almost double between 2001 and 2020 (Quirke et al. 2003).

This rising demand for beef presents poor livestock producers with significant opportunities to increase the benefits gained from their livestock and raise income through increasing livestock sales. However, at the time of this publication, there have been few documented examples of smallholder farmers being able to take advantage of these opportunities. This chapter describes one such example in which smallholder families in Vietnam, whose livelihood was based on small, diversified crop–livestock farms, were able to change from being traditional "cattle keepers" to becoming market-oriented "cattle producers" within a relatively short time span. A series of small research-for-development projects provided interventions that both catalyzed and supported this development (Table 6.1).

The case-study location was Ea Kar district, Daklak Province, Vietnam and the study covers the period from 2000 to 2010. Data and information presented are based on information extracted from project reports and presentations, interviews with key informants, and primary data collected during the Fodder Adoption Project; these include adoption surveys in 2007 and 2010, and market studies in 2004 and 2008. The chapter describes the changes in production, marketing, and innovation capacity, analyzes the key factors that were instrumental in enabling this transition, and draws lessons on the changing needs for intervention strategies at different stages of the intensification process.

Site Description, Research Process, and Methods

Description of Ea Kar

Ea Kar is one of the 13 districts of Daklak Province in the Central Highlands of Vietnam. It is well connected by sealed road to Buon Ma Thuot (1.5 hours by car), the provincial capital of Daklak, and to Nha Trang (2.5 hours by car) on the main coastal north–south route. The landscape is undulating and partially mountainous. At the time of the study, 40 percent of the total land area of 104,000 ha was used for agriculture and 52 percent was declared forest (Daklak Statistics Office 2008). Agriculture accounted for 65 percent of the district's GDP, and more than 80 percent of Ea Kar's population depended on agriculture for their livelihood. Smallholder families subsisted by growing a diverse range of foodcrops, livestock, and fish for home consumption and sale to generate family income. Farm sizes were small for upland agriculture

TABLE 6.1 Research projects implemented in Ea Kar, Daklak, Vietnam, 2000–2010

Project title	Forages for Smallholders Project-2 (FSP-2)	Livelihood and Livestock Systems Project (LLSP)	Enhancing livelihoods of poor livestock keepers through increasing use of fodder (Fodder Adoption Project, FAP)
Period	2000–2002	2003–2005	2007–2010
Countries included	Southeast Asia regional project including Vietnam	Southeast Asia regional project including Vietnam	Ethiopia, Syria, and Vietnam
Donor	Asian Development Bank (ADB)	Asian Development Bank (ADB)	International Fund for Agricultural Development (IFAD)
Implementing agency	• International Center for Tropical Agriculture (CIAT) in collaboration with national partners. • In Ea Kar: Tay Nguyen University (TNU), the National Institute of Animal Science (NIAS), and the Ea Kar extension office (DEO)	• CIAT in collaboration with national partners. In Ea Kar: TNU, NIAS, DEO, and commune extension workers	• International coordination by the International Livestock Research Institute (ILRI) on behalf of the System-wide Livestock Programme of the CGIAR. • In Ea Kar: implemented by CIAT, TNU, NIAS, DEO, district government, and commune extension workers
Objective in Ea Kar	Developing and integrating forage technologies for smallholder farmers	Improving livestock production through forage-based feeding systems	Building innovation capacity for fodder and cattle development
Activities	• Participatory evaluation of forage varieties with individual farmers in several villages	• Developing improved feeding systems with farmer groups • Up-scaling of forage-based feeding systems to more villages in Ea Kar	• Facilitating the involvement of a broad range of stakeholders in cattle development • Improving market linkages • Building stakeholders' capacity for cattle production and marketing
Outputs and outcomes	• Farm-grown forages, grown on farmers' own land and used to supplement cattle, adopted by participating smallholder farmers • Adoption of forage technologies by more than 2,000 farmers in Ea Kar, and move toward stall-fed cattle fattening (buy thin, sell fat)	• Improved cattle productivity and increased income from forage-based cattle production	• Changed cattle-production system from traditional "cattle keepers" to market-oriented "cattle producers" • Adoption of forage technologies by more than 3,000 farmers and adoption of market-oriented cattle fattening and breeding by more than 1,300 farmers in Ea Kar

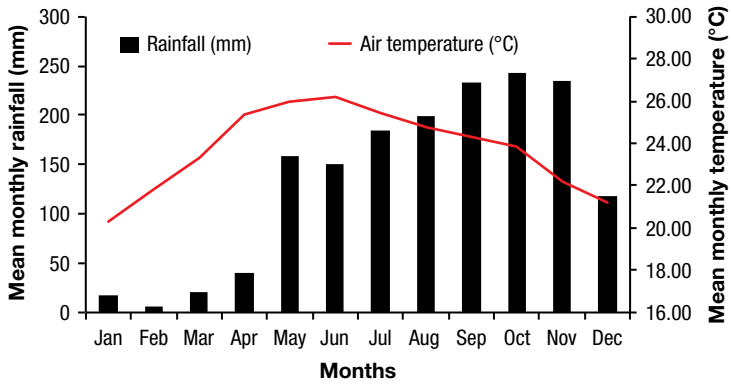
Source: Authors.

with an average land area of 1.3 ha. The main crops grown were hybrid maize and cassava; coffee and fruit trees were cultivated on the most fertile soils (16 percent); paddy rice was grown in valleys and other flat areas (12 percent); and a range of other annual upland crops were also cultivated. Crop yields

were constrained by low soil fertility (with the exception of small pockets of fertile red basaltic soils, 16 percent of agricultural land) and a cool dry season from January to April (Figure 6.1). From 2003 to 2009, the mean annual rainfall was 1,605 mm, varying from 950 mm in 2004 to 2,230 mm in 2005.

Most rural households raised several livestock species, including pigs, poultry, and cattle, and some households had small fish ponds. Traditionally, cattle had been used for draught power and asset accumulation, and many smallholders now raised one to three cattle as part of a diversified smallholder livelihood. Cattle were raised to preserve cash: farmers bought cattle whenever cash was available and sold animals when funds for major expenses were needed. Thus, cattle were a cash reserve rather than a way of generating regular income for the family. Farmers grazed cattle on grass, herbs, and shrubs growing along roadsides, fields, and waterways, and in nearby forests. In intensively cropped lowland areas, farmers supplemented grazing with freshly cut native grasses and crop residues such as rice straw. There were two main problems with this type of production system: (1) feed supply was insufficient for good animal growth, as animals were unable to find enough fodder on heavily grazed or utilized land; and (2) cattle management was labor-intensive, as grazing needed to be supervised in cropping areas and hand cutting of short, native grasses was time consuming. This situation has resulted in thin animals with poor reproductive performance and a low meat yield at slaughter. Animals, therefore, were sold at local markets for local consumption only. For traders to access urban markets, cattle

FIGURE 6.1 Mean monthly rainfall and air temperature in Ea Kar, 2003–2009



Source: Daklak Statistics Office (2007, 2008, 2009).

needed to be in a much better condition and this could only be achieved if farmers changed the way they raised, produced, and marketed cattle.

Research Process

Three research projects contributed directly to cattle development in Ea Kar (Table 6.1). The nature and focus of these projects gradually changed over the ten years and this evolution provided insights into the types and sequencing of interventions required at different stages of the innovation process.

Based on earlier research by CIAT that had identified forage varieties suitable for different agroecosystems in Southeast Asia (Stür et al. 2002), the Forages for Smallholders Project (FSP, 2000–2002) introduced a range of promising forage varieties and evaluated these with individual smallholder farmers in three villages in Ea Kar, using a farmer-participatory approach. The Livelihood and Livestock Systems Project (LLSP, 2003–2005) continued working with these farmers to develop new, improved feeding systems that combined and integrated the new fodder resource—the farm-grown forages—with the existing feed resources. A key intervention was the fattening of thin cattle before sale to achieve a higher sale price. Farmers provided ad libitum fodder to stall-fed cattle for 1–2 months, adding 25–50 kg of liveweight to animals before sale. Later, supplemental feeding using cassava meal, rice bran, and other farm-grown crops and crop by-products was also introduced to further improve the growth rate of cattle, and feeding systems were then tailored to different production systems such as cattle fattening and cow–calf production. As the project progressed, activities expanded to more villages and communes, and scaling up became a focus of the project. Increasingly, the project worked with farmer groups rather than individual farmers and engaged with local organizations such as farmers' and women's unions. Extension tools, such as cross-visits, field days, and farmer training, were facilitated and implemented by extension workers who had received training by project scientists. In 2004, the LLSP conducted a rapid cattle-market appraisal that brought farmers and traders together to discuss constraints and opportunities for improving marketing of cattle from Ea Kar. Commencing in 2007, the Fodder Adoption Project (FAP, 2007–2010) drew on innovation-systems thinking (World Bank 2006) and engaged with a wide range of stakeholders, strengthening capacity of local stakeholders to improve smallholder cattle production and marketing in Ea Kar. The project combined participatory approaches to developing and extending agricultural technologies (for example, Horne and Stür 2003) with an innovation-systems approach (for example, World Bank 2006; Hall et al. 2007). The focus of activities was on stimulating farmer

links to urban markets, improving the efficiency and quality of cattle production to enable farmers to access these markets, and building capacity of local stakeholders for sustainable cattle development.

Methods

The results presented are based on information gathered from reports, presentations, and publications of the FSP, LLSP, and FAP projects, and primary data collected during the LLSP and FAP projects. These include the results of adoption surveys in 2007 and 2010, and market studies in 2004 and 2008.

The first adoption survey was conducted in September 2007 and aimed to interview all farmers who were growing forages in Ea Kar. District and commune extension workers visited all communes and villages in Ea Kar and interviewed commune officials, village heads, and other key informants on forage development in their village, and assembled a list of households that had adopted forages (adopters). The extension workers arranged visits to all adopters and one adult household member was interviewed using a simple one-page structured questionnaire. The questionnaire included questions on basic household information, crops and livestock resources, and planting of managed forages. In 2010, a second adoption survey was carried out in two stages: first, the survey team interviewed commune officials, village heads, and other key informants in each of the 15 communes (and 259 villages) where forage and cattle development was known to have taken place, to determine the number of households with cattle and the type of production systems used (that is, traditional grazing, use of farm-grown forages, fattening of cattle, cow–calf production, or mixed production systems). The team then randomly selected a subset of 54 households for a more detailed survey, which elicited detailed information on adoption, management, and productivity of forage and cattle production. The selection process was in two stages: first, the team randomly selected 5 of the 15 communes; second, they randomly selected 54 households from the list of households engaging in cattle production in these communes. Data were summarized and analyzed using a spreadsheet.

The first cattle-market study was carried out in 2004 (Khanh et al. 2004). During the study, key informants were interviewed. Separate group discussions with local government representatives, cattle producers, and traders were facilitated during which each group discussed the history of cattle development and marketing, identified current stakeholders in the market chain, mapped market chains, and discussed constraints and opportunities for improving cattle marketing. The outcomes of the discussions were reported at feedback workshops with all stakeholders. A second market study was carried out in 2008. This study used the Rapid Market Appraisal (RMA) method developed for agricultural

commodities (Wandschneider et al. 2007). The main components of the RMA were:

- interviews with key informants;
- collection of secondary data;
- group discussions with three farmer groups representing different cattle-production systems (traditional extensive grazing, stall-fed cow–calf production, and cattle fattening);
- group discussions and individual interviews with eight small and four large traders in Ea Kar;
- interviews with relevant district authorities;
- interviews with individual traders and other stakeholders involved in the market chain at the three main destination markets of Buon Ma Thuot, Da Lat City, and Ho Chi Minh City where most of the cattle from Ea Kar were sold; and
- a feedback meeting with all stakeholders in Ea Kar to discuss the results of the market study and explore opportunities for improving cattle production and marketing.

The field surveys (data collection, interviews, and group discussions) were conducted between 15 June and 15 September 2008. Destination market surveys were carried out in December 2008. The LLSP and FAP projects facilitated participatory market studies taking farmer-club leaders, local traders, and local government representatives to possible destination markets to observe operations and discuss market opportunities with traders, slaughterhouse operators, and meat-market stakeholders, and develop linkages with urban markets. Details of this study have been published separately (Khanh and Stür 2012). Building capacity of researchers and extension workers in participatory research, forage, animal nutrition and feeding systems, market studies, and innovation systems approaches was an integral part of the research projects.

Results

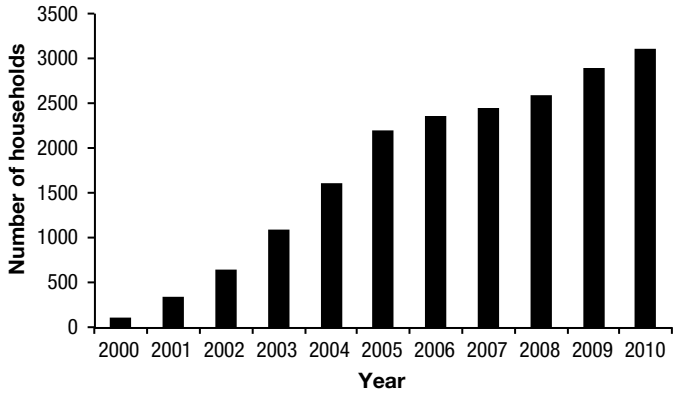
The system changes relating to cattle development in Ea Kar will be presented in three parts: (1) intensification of cattle production, (2) accessing new markets, and (3) institutional and stakeholder dynamics.

Intensification of Cattle Production

FODDER PRODUCTION AND USE

In 2000, the FSP introduced the concept of farm-grown fodder production to smallholder farmers in Ea Kar by introducing a range of forage grasses and legumes that were likely to be well adapted to local conditions. The notion of growing fodder for their cattle on their own land was a novel idea for farmers used to exploiting common-property resources to feed their animals. Despite this, farm-grown fodder was rapidly adopted by farmers, with the highest adoption rates occurring from 2003 to 2005 (Figure 6.2). By 2010, more than 3,100 farm households, or 31 percent of all households with cattle, had adopted fodder production (Figure 6.2, Table 6.2). When interviewing farmers who had recently started growing forages about the reasons for adopting forage production, they invariably listed labor savings and improved body condition of their animals as the main reasons for growing forages. They commented that they now had a ready fodder resource next to their house and it took only a few minutes to cut feed for their cattle; they no longer needed to send family members to herd cattle for long periods, contradicting the often-held view that zero grazing is more labor demanding; and they could also keep their cattle close to their house. In 2005, a small study comparing cattle-production labor use of 27 fodder-crop adopters and 20 nonadopters in Ea Kar showed that, on average, adopters spent 3 hours per day while

FIGURE 6.2 Farmers growing fodder in Ea Kar, 2000–2010, for the FSP (Forages for Smallholders Project, 2000–2002), LLSP (Livelihood and Livestock Systems Project, 2003–2005), and FAP (Fodder Adoption Project, 2007–2010) projects



Source: FAP adoption surveys in 2007 and 2010; District Extension Office (pers. comm.) for other years.

TABLE 6.2 Fodder adoption in Ea Kar, 2007 and 2010

Characteristic	2007	2010
Total number of smallholders in Ea Kar (HH)	31,690	31,800
HH with cattle (percent)	34.0	31.6
Mean number of cattle per HH growing forages (cattle/HH)	3.2	4.3
HH with fodder production (HH)	2,407	3,101
Fodder adoption rate of HH with cattle (percent)	22.3	30.9
Average size of fodder area per HH (m^2)	887	1,309

Source: Fodder Adoption Project (FAP) surveys, 2007 and 2010.
Note: HH = households.

nonadopters spent 6.8 hours per day looking after their cattle. The return to labor was US$0.73 per hour for adopters and $0.16 per hour for nonadopters. While this was only a snapshot, it confirmed the assertion by farmers that labor savings were a major factor driving fodder adoption.

The main fodder crops selected and grown by farmers in Ea Kar were the grasses *Panicum maximum* "Simuang," *Pennisetum purpureum* "Napier," and a *Pennisetum* hybrid "VA06," with smaller areas of the grasses *Paspalum atratum* "Terenos" and *Brachiaria* hybrid "Mulato 2," and the legume *Stylosanthes guianensis* "CIAT184." Grasses rather than legumes were adopted more frequently by farmers as grasses produced higher fodder yields than legumes, and quantity of fodder (rather than quality) was the first concern of farmers. During the first few years, most farmers grew only small areas, 100–200 m^2, as they evaluated the potential of forages. Later adopters immediately grew larger areas, 500–1,000 m^2, which were sufficiently large to impact animal growth positively. By 2007, the average fodder area per farm was 887 m^2 and by 2010 it had increased to 1,309 m^2 (Table 6.2). Farmers grew fodder crops on land that had previously been planted with other crops such as coffee, maize, or cassava, often on land marginal for crop production. The preference for grasses also had the advantage that these could be propagated vegetatively from cuttings and rootstocks, which eliminated the need for developing a seed-supply system. The researchers promoted sale of (rather than provision of free) planting material, which enabled early adopters to sell small amounts of planting material to other farmers who also wanted to evaluate farm-grown fodders, and this provided an extra incentive for early adopters. For new farmers, the cash investment needed was small as they could start with only a few plants for multiplication and then produce their own planting material.

Forage productivity was high, as almost all farmers applied manure recycled from cattle pens and small amounts of inorganic fertilizer, usually nitrogen fertilizer, to their forage crops. Also, farmers managed forages in the same way as they did foodcrops: they grew forages in rows and cut and carried the fodder to animals to maximize forage productivity. Most farmers irrigated at least part of their fodder area during dry periods, mainly using existing irrigation equipment purchased for coffee production. The average size of 1,309 m^2 of forage-production area was sufficient to produce fodder for fattening of two cattle at any one time.

The intensive fodder production had few negative impacts. At the end of the study in 2010, households had committed only 10 percent of their farm area to fodder production, which allowed them to continue to use most of their agricultural land for crop production and other livestock activities, and so maintain diversified agricultural production. Fodder crops were cut frequently and so produced little or no seed that could potentially grow as a weed in unwanted situations. There was no evidence of invasive tendencies of the forages grown as fodders. The application of manure ensured that nutrients contained in cut fodder were replaced and productivity of fodders and soil fertility were maintained.

Adoption of forage production among different communes in Ea Kar varied considerably, ranging from 1 to 95 percent of farms with cattle (Table 6.3). Uptake was less common for farmers living in remote communes such as Cu Lang and Cu Bong, and more common for those living in communes with easy access to main roads and the district center, such as Ea Dar, Ea Mut, and Ea Pal. In community consultations, local stakeholders identified several factors that contributed to this differential adoption, including level of access to grazing lands, tradition of cattle grazing, poverty, and access to extension services. People in more remote communes tended to have easier access to grazing lands, so there was less pressure to find new feed resources; they tended to belong to ethnic-minority groups with a long history of cattle grazing; they were poor and had little access to credit to engage in cattle fattening; and they had limited interaction with the government extension services.

INCREASE IN CATTLE POPULATION, AND CHANGE OF BREEDS AND MANAGEMENT

Between 2003 and 2005, cattle population in Ea Kar almost tripled from approximately 10,000 to 29,000 animals and then remained at 25,000–28,000 animals from 2006 onwards (Daklak Statistics Office 2009). The two main cattle breeds raised by smallholders in Vietnam were native Yellow cattle with a mature bull weight of 200–250 kg and "Laisind," a stabilized cross

TABLE 6.3 Fodder adoption by commune, 2010

Commune	Distance from district town (km)	Distance from main road (km)	Farms with cattle	Farms with forages	Forage adoption (%)
Thi Tran (district township)	0	0	279	82	29
Ea Mut	5	0	538	262	49
Cu Ni	5	2	864	222	26
Cu Hue	8	3	587	175	30
Ea Dar	10	0	769	373	48
Ea Knop (secondary township	10	0	389	177	46
Xuan Phu	10	5	539	102	19
Ea Pal	15	3	782	740	95
Ea O	15	5	793	232	29
Cu Prong	18	5	422	74	18
Ea Tyl	25	0	995	211	21
Cu Yang	25	3	548	201	37
Ea So (including Ea Sa)	25	5	994	159	16
Cu Lang	30	15	643	5	1
Cu Bong	35	10	900	86	10
All communes			**10,044**	**3,101**	**31**

Source: Fodder Adoption Project (FAP) surveys, 2007 and 2010.

of native Yellow cattle × Red Sindhi cattle, with a higher mature bull weight of 300–450 kg (NIAH 2007). The main cattle breed raised traditionally by farmers in Ea Kar was Yellow cattle. The Ea Kar district extension office estimated that, in 2000, the breed composition consisted of 80 percent native Yellow and 20 percent Laisind cattle. By 2007, the percentage of native Yellow cattle was 74 percent with the remainder made up mostly of Laisind cattle and a small percentage of crossbred cattle. Crossbred cattle (Laisind × exotic breeds such as Brahman or Droughtmaster) were the result of an artificial insemination (AI) program offered by the government. Breed composition changed dramatically from 2007 to 2010. By 2010, the percentage of native Yellow cattle had declined to 40 percent, while the percentage of Laisind and crossbred cattle had increased to 37 percent and 23 percent, respectively.

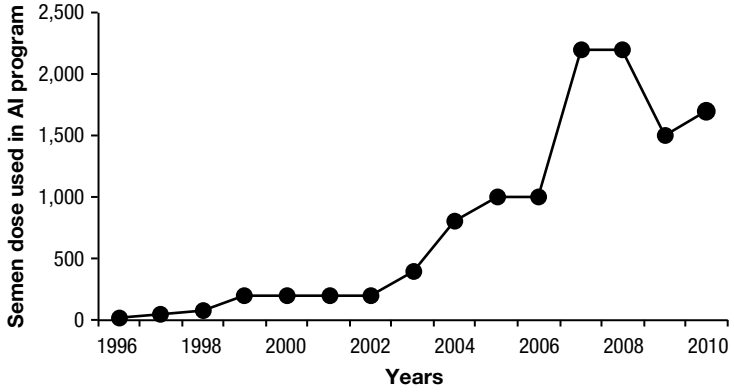
Growing their own fodder enabled farmers to raise cattle in pens for calf production. Farmers could control and manage breeding, which had previously been almost impossible when cattle were grazed on communal land.

When keeping cattle in pens, farmers could observe their animals more closely and could arrange AI and animal-health services more easily. AI, using exotic semen, had been offered by the district extension office from 1996, but was only taken up widely from 2003 onwards (Figure 6.3). The uptake of AI was relatively unrelated to the cost. AI was offered free of charge to all farmers until 2000. From 2001 to 2007, semen was still supplied free of charge, but farmers had to pay a small service fee for insemination. Since 2008, farmers have had to pay for both semen and insemination service themselves with charges ranging from US$13 to $18 for each successful insemination. While the jump in the cost of AI reduced demand in 2009, there were many farmers who were willing to pay for successful AI.

MOVING TOWARD SPECIALIZED CATTLE PRODUCTION

Farmers started to specialize in stall-fed cattle fattening and/or stall-fed cow–calf production using AI or Laisind bulls for breeding. Fattening cattle and cow–calf production in pens using farm-grown fodder was a relatively new concept for smallholder farmers. In 2003, only three farms experimented with cattle fattening. By 2010, some 525 farms were fattening cattle and all used farm-grown fodder (Table 6.4). In comparison to cattle fattening, the adoption of farm-grown fodder for cow–calf production was much lower and many farmers continued to use traditional grazing systems (Table 6.4). Of the farmers who adopted forages, many used farm-grown fodder as a supplement to grazing, though some moved to stall-fed cow–calf production with

FIGURE 6.3 Semen doses used in the Ea Kar artificial insemination (AI) program, 1996–2010



Source: District Extension Office, Ea Kar (pers. comm.).

TABLE 6.4 Cattle production systems and fodder adoption, 2007 and 2010

Production system	2007		2010	
	Households with cattle	Forage adoption (percent)	Households with cattle	Forage adoption (percent)
Cattle fattening	501	96	525	100
Cow–calf system	10,134	19	9,770	28
All farms with cattle[a]	10,614	23	10,044	31

Source: Fodder Adoption Project (FAP) surveys, 2007 and 2010.

Note: [a] Some farms operated both cow–calf systems and fattened cattle at the time of the survey, thus the total is smaller than the sum of the two production systems.

farm-grown fodders used as the main feed. The Ea Kar extension office estimated that, by 2010, more than 800 farms were practicing stall-fed cow–calf production using AI or Laisind bulls for breeding.

While the total number of farmers fattening cattle changed little between 2007 and 2010 (Table 6.4), there were other major changes in the production system (Table 6.5). By 2010, farmers had increased the number of animals fattened at any one time from averages of 1.5 to 3.9 animals per cycle; they fattened more Laisind and crossbred cattle; they fattened younger animals that required a longer fattening period; and achieved a higher slaughter weight and a higher weight gain. To achieve these weight gains, farmers fed cattle with fresh fodder ad libitum (approximately 32 kg of fresh grass per animal per day), and supplemented this with an average of 2.9 kg of farm-mixed concentrates consisting of maize, rice bran, cassava meal, and fish meal. Ingredients for concentrates were largely locally grown, often on farm or easily available from local sources. As farmers gained experience, they were able to modify supplement ingredients to match animal needs during different stages of fattening.

TABLE 6.5 Cattle fattening characteristics, 2007 and 2010

Characteristic	2007	2010
Forage area (m^2)	890	2,860
Number of cattle per fattening cycle	1.5	3.9
Percentage of native cattle breeds	74	8
Age of animal at start of fattening (months)	33	14
Length of fattening cycle (months)	2.5	4.5
Starting weight (kg)	229	252
Finishing weight (kg)	295	355
Daily weight gain (g/day)	670	770

Source: Based on cattle fattening survey, 2007 and Fodder Adoption Project (FAP) survey, 2010.

The research projects provided training in animal nutrition and feed formulation, and facilitated farmer-group experiments on low-cost feeding systems with locally available concentrate ingredients.

The production focus was also reflected in herd structure. In 2010 cows, heifers, and calves/young growing cattle accounted for approximately 80 percent of the cattle population. Most of the remaining cattle were being fattened for slaughter at the time of the survey. Many of the native cattle were sold as "calf beef" aged 12–18 months. A comparison with the 2007 adoption survey is not available as herd structure was not elicited in the 2007 survey; however, the 2010 data clearly indicate a herd structure consistent with a production rather than the traditional "savings" focus. It was observed that the use of cattle for draught purposes declined, while mechanized land preparation increased during the study period. Households that traditionally used cattle as a way of preserving capital found it harder to do so as access to grazing lands diminished, but alternative investments such as cattle fattening emerged at the same time.

ACCESSING NEW MARKETS

In the four years between 2004 and 2008, substantial changes occurred in the quantity and quality of cattle supplied to destination markets, and the way cattle were marketed from Ea Kar. In 2004, the vast majority of cattle produced in Ea Kar were sold for use in Ea Kar and nearby districts. Farmers sold cattle to small, local traders or, less frequently, directly to other farmers. Of the cattle they bought, traders sold 70 percent of the animals to other farmers for breeding or growing, and 30 percent for slaughter. By 2008, this situation had changed and 85 percent of cattle were sold for consumption in the urban markets of Ho Chi Minh, Da Lat, Nha Trang, and Buon Ma Thuot, and only 15 percent were consumed in Ea Kar (Table 6.6). Sourcing and marketing of cattle varied considerably among the different production systems (Table 6.6). Farmers who had specialized in cattle fattening bought young male crossbred or Laisind cattle and sold fat cattle directly to large traders. Farmers who specialized in stall-fed cow–calf production sold crossbred or Laisind calves and/or fattened these themselves for sale to large traders. Farmers using the traditional cow–calf production continued to sell mostly to small traders or directly to other farmers.

During the 2008 market study (Khanh and Stür 2012), large and small traders were asked to estimate the number of cattle sold for slaughter (off-take) from Ea Kar from 2004 to 2008. The traders estimated that off-take increased from 6,000 animals in 2004 to 17,000 animals in 2008. During the same period the cattle population increased only slightly, from 23,000 to

TABLE 6.6 Marketing chain of cattle produced in Ea Kar, 2008

Production system	Stall-fed cattle fattening	Stall-fed cow–calf production	Traditional cow–calf production
Farmers	• Bought crossbred and Laisind cattle for fattening • Sold cattle to large traders (100%)	• Occasionally bought cows for breeding and used AI • Sold Laisind and cross-bred calves and some farmers also sold fat cattle to large traders (50%), other farmers (40%), and small traders (10%)	• Seldom bought animals • Sold mainly native Yellow and some Laisind calves and mature cattle to small traders (75%) and other farmers (25%)
Small traders	• Bought cattle from traditional cow–calf producers (60%) and from stall-fed cow–calf producers (40%) • Sold fat cattle to large traders (70%) and calves and thin cattle to farmers (30%)		
Large traders	• Bought fat cattle from farmers (50%) and small traders (50%) • Sold fat cattle for slaughter to urban markets (75%), for slaughter in Ea Kar and sale as chilled meat to urban markets (10%), and for slaughter and local consumption in Ea Kar (15%)		

Source: Modified from Khanh and Stür (2012), based on the cattle marketing study, 2008.

28,000 animals. This increased off-take indicated (1) a transition to regular sale of animals, (2) more efficient production systems, and (3) import of animals from other districts for fattening in Ea Kar.

Different destination markets had different criteria for accepting cattle for slaughter with stricter quality criteria in urban markets (Table 6.7). The two most important factors deciding acceptance and price were the live body weight and the body-condition score of cattle (score of 1–5; with 1 very thin

TABLE 6.7 Cattle quality criteria of different markets, 2008

Quality criteria of cattle sold for slaughter in different markets	Ea Kar	Buon Ma Thuot	Nha Trang	Da Lat	Ho Chi Minh
Distance from Ea Kar (km)	0	67	125	222	407
Destination markets for cattle from Ea Kar (%)	15	35	10	20	20
Body condition score (1 = very thin; 5 = very fat)	Any	Any	First-grade chilled beef [a]	≥4	≥4
Live body weight (kg)	Any	Any	First-grade chilled beef [a]	≥300	≥300
Age (years)	Any	Any	First-grade chilled beef [a]	≤3	≤4

Source: Modified from Khanh and Stür (2012).

Note: [a] First-grade chilled beef = slaughter of cattle with good body condition (≥4) and young age (≤4 years) but using only prime cuts of the animals with the remaining meat being sold on local markets.

and 5 very fat). The third most important criterion was the age of animals. The markets in Da Lat and Ho Chi Minh City were looking for relatively young, heavy animals with a body condition score of 4–4.5. Animals that were too fat (body condition score of 5) were not encouraged, whereas in the local Ea Kar market all animals regardless of body condition were accepted.

Traders in Da Lat did not accept cattle that did not meet the quality requirements. In Ho Chi Minh City, traders accepted them but paid a lower price. In Vietnam, the farm price for cattle is based on the amount of lean meat on the carcass, as estimated visually by the traders and farmers. The traders and farmers agree upon the amount of lean meat on the carcass and multiply this amount by the price of beef sold at the market at that time. Traders in Ea Kar were willing to pay an extra VND200,000 to 500,000[2] per head (US$10–30 per animal) for cattle meeting all quality criteria of the destination market. Competition among traders for buying good-quality animals was high. Farmers consistently reported that there were many traders who were willing to buy their fattened animals and they generally asked at least three traders to make offers for the animals they wanted to sell.

The price of beef sold in urban markets had increased steadily, despite the recent economic crisis, by an average of 9 percent per year from $2.30/kg in 2000 to $5.60/kg in 2010. Farmgate prices rose correspondingly and these relatively consistent price increases have been a major factor attracting farmers to engage in cattle production.

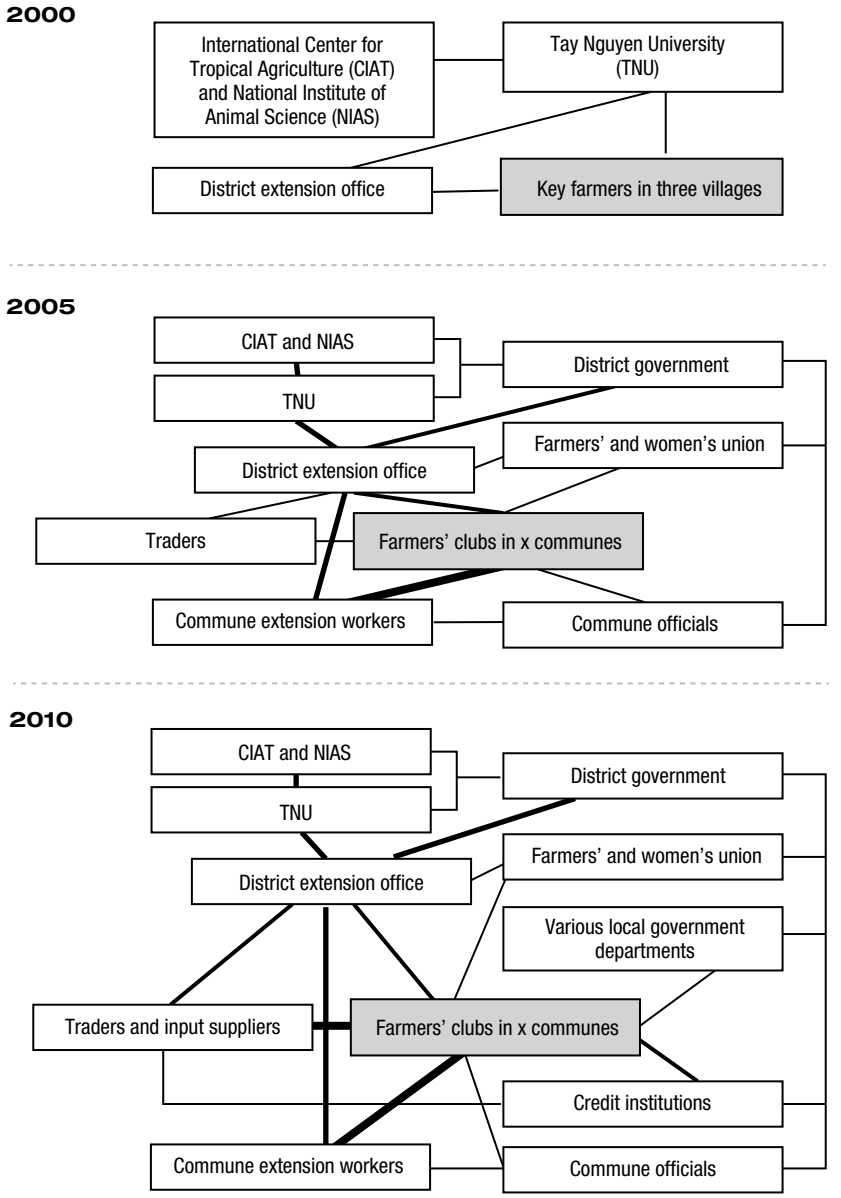
In 2009, for the first time, a farmer group entered into a group contract with a large trader to regularly supply high-quality cattle at agreed quantities and prices. Other farmer groups also entered into contracts with traders in 2010. Feedback from traders was that there was strong demand for high-quality beef in urban markets. Conversely, the market for smaller, native animals was less promising and prices paid for such animals were low. Currently, Ea Kar farmers supply only a fraction of the demand for quality meat in urban centers and there is ample opportunity for increasing supply.

INSTITUTIONAL AND STAKEHOLDER DYNAMICS

As the focus moved from forage research (2000–2002) to developing feeding systems and extending forages to more farmers (2003–2005) and then to strengthening the capacity of stakeholders to improve cattle production and marketing (2007–2010), the number of stakeholders involved and their roles, interactions, and practices evolved (Figure 6.4).

2 VND is Vietnamese Dong.

FIGURE 6.4 Stakeholder linkages in 2000, 2005, and 2010 (the thickness of lines indicates the strength of interaction between stakeholders)



Source: Modified from Khanh et al. (2009).

In 2000, the process started with on-farm research involving a small number of farmers in three villages (Table 6.8). Researchers from Tay Nguyen University worked directly with farmers with the participation of district extension workers. As forage and livestock development expanded to more farmers and new communes, the number of stakeholders involved increased.

By 2005, the district extension office had become the communication and facilitation hub for forage and livestock development. The district government had recognized the importance of forage production as a means of enabling intensification of smallholder cattle production and provided political and financial support for cattle development. They also facilitated linkages with commune officials and farmers' and women's unions. By now, commune extension workers were actively involved as the main facilitators of interactions with farmers. Fodder and cattle development had spread to 51 villages in 10 communes (Table 6.8). Extension workers no longer worked with individual farmers, but had facilitated the formation of self-managed farmer clubs (that is, groups of 10–15 farmers interested in cattle development, usually located in a commune or a cluster of villages to enable easy participation) to facilitate extension activities, farmer training, and learning. Farmer clubs were regulated and managed by their members and included a broad cross-section of farmers including poor households. They were the central element in experimenting with new cattle-production systems and providing feedback to researchers, extension workers, and local government. Extension workers facilitated cross-visits between farmer clubs and asked experienced farmers to share their experiences with farmers from other, less-experienced clubs. Researchers continued to develop interventions for improving production

TABLE 6.8 Geographic spread, extension workers, and farmer clubs involved in fodder and cattle development

Characteristic	2000	2005	2010
Number of communes with fodder and cattle development	3	10	15
Number of villages with fodder and cattle development	3	51	259
Extensionists involved in cattle development • at district level • at commune level	 1 3	 3 10	 3 30
Number of farmer clubs with a fodder and cattle development focus	0	25	43

Source: Authors.

systems, and provided training to extension workers and methodological support to the district extension office. Traders, who had participated in the 2004 market study, investigated access to larger provincial and urban markets, and developed linkages with large traders and slaughterhouse operators in destination markets.

By 2010, fodder and cattle production knowledge and practice had spread to many more villages and communes, and the number of extension workers and farmer clubs involved in these processes had increased considerably (Table 6.8). The number of stakeholders and the complexity of interactions had increased further (Figure 6.4). Traders, input suppliers (for example, AI), and credit institutions had become important stakeholders, interacting directly with farmers and farmer clubs, although the central role of the district extension office in facilitating interactions had continued. The district extension office ensured that traders, together with other key stakeholders, were consulted and invited to all meetings on how to improve cattle development. The role of researchers had continued to evolve into a more supportive rather than driving role for cattle development.

Researchers continued on-farm research on issues arising from the rapidly changing production systems, provided training, monitored and evaluated adoption patterns, and conducted market studies to provide local government and other stakeholders with data and information as a basis for decisionmaking. Farmer clubs had grown in size to an average of 20 (range 15–40) members. The district government had facilitated access to credit for cattle production through local credit institutions, and had investigated the establishment of more efficient market mechanisms in Ea Kar. Credit for cattle fattening was available through local banks for the more affluent farmers. Other farmers had limited access to credit provided they belonged to a farmer club that supported their application and provided training and support to the applicant. In collaboration with the Social Bank, the project successfully facilitated a "credit through traders" scheme that enabled poor farmers from ethnic-minority groups to engage in cattle fattening. For more details on this scheme see Khanh et al. (2011a).

Discussion

The question "Can developing-country crop–livestock systems be transformed to address the increasing demand for meat or will integrated smallholder systems be replaced by intensive industrial production systems?" has been posed by many authors (for example, Tarawali et al. 2011; Udo et al.

2011). This case study shows that smallholder farmers in Ea Kar were able to convert from traditional cattle production to efficient market-oriented production and compete successfully in city markets with other suppliers. While this is only one example, the study contributes to a greater scientific understanding of development processes and provides an opportunity to draw general lessons.

The research projects that supported forage and cattle development in Ea Kar evolved from a purely technical focus on farm-grown forages to a broader systems perspective. Throughout the ten-year period, the research approach had a strong emphasis on participatory research that responded to farmers' needs and identified opportunities for research and development (described in greater detail in Horne and Stür 2005), nurtured partnerships and local decisionmaking, provided training and, apart from the initial period when forages were first introduced, considered both the supply and demand sides of cattle development. Many of these elements are encompassed in an innovation-systems perspective, which considers innovation as a complex interactive learning process involving multiple actors, institutions, and organizations with different roles, agendas, and practices (for example, Hall et al. 2003, 2007; World Bank 2006; Spielman et al. 2008). This also fits with Edquist and Hommen's (1999) point of view that a "systems-oriented view of innovation accords great importance to the demand side, rather than concentrating primarily, if not exclusively, on the supply side," this latter having been the hallmark of the linear innovation or technology supply push approach (Hounkonnou et al. 2012). In Ea Kar, the nature of interventions changed as the production system intensified from purely production interventions in the early years to mostly market-level interventions toward the latter part of the case-study period.

Many factors contributed to the transition to more market-oriented cattle production in Ea Kar. Strong market demand in urban centers as a driving force for livestock development has been well recognized (for example, McDermott et al. 2010; Tarawali et al. 2011) and clearly played a key role in this case study. Other contextual factors included the strong desire of Ea Kar farmers to improve their livelihood, the cohesive nature of the district extension service, the supportive district government, and the availability of technical expertise from Tay Nguyen University. However, prior to the start of the R&D effort, farmers and local traders had not been able to access these markets because the type of animal produced in the traditional production system was acceptable only in local markets with limited demand. The lack of fodder had been identified as a major constraint to cattle production in

participatory research with smallholder farmers, and the introduction of farm-grown forages enabled farmers to produce fatter animals and reduce labor inputs in cattle production by moving from grazing to stall-fed animals. Traders were only able to develop access to provincial urban markets once farmers were able to produce fatter animals following the introduction of fodder interventions, that is, farm-grown forages. The attribute of farm-grown forages to substantially reduce labor requirements for cattle production and improve educational outcomes of children previously employed in supervising grazing of cattle has also been documented by Maxwell et al. (2012).

The early impact of this innovation provided a vision for farmers, traders, and local government that catalyzed stakeholder interest and involvement in cattle development. Starting with a simple relationship involving researchers, farmers, and extension workers, with time, the stakeholder configuration expanded to include other actors such as local government planners, traders, and credit institutions. Biggs and Smith (1998) used the term "development coalition" to describe such loosely structured, opportunistic groups of actors and, in their analysis of two case studies, concluded that coalition-building was a key ingredient for successful technology development and dissemination. This conclusion was supported by Cramb (1999), who used an "actor-oriented perspective" to analyze adoption of soil-conservation methods by smallholders in the Philippines. He also emphasized that the interests of key actors had to converge sufficiently for them to allocate resources and efforts on working toward change. In the Ea Kar case study, this impetus was created by the success of farm-grown fodder emerging from participatory forage development. For farmers, cattle production became more profitable, local traders could see opportunities of accessing new markets, extension workers were successful in disseminating forages to more farmers, and local government realized that cattle development provided an avenue for raising incomes of smallholders. Interests converged, and forage and cattle development became a focus for the district.

The district extension workers stepped into the role of facilitator or broker of the loosely structured development coalition. Through this networking role they were able to connect farmers with information and the knowledge of other stakeholders such as traders, researchers, and credit institutions, thus becoming "innovation intermediaries" (Spielman et al. 2008; Poncet, Kuper, and Chiche 2010). An important aspect of the development coalition was its local facilitation that ensured local ownership of and responsibility for the process. External facilitation may not have resulted in the strong level of ownership and commitment that was apparent in this case. A feature of the

coalition was the strong mutual respect and friendship that developed among stakeholders and adherence to good partnership principles. Brinkerhoff (2002, 21) defined these as follows:

> Partnership is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labour based on the respective comparative advantages of each partner. Partnership encompasses mutual influence, with a careful balance between synergy and respective autonomy, which incorporates mutual respect, equal participation in decision making, mutual accountability and transparency.

There is currently a lot of interest in the use of so-called innovation platforms as catalysts for innovation in rural research-for-development circles. See, for example, a recent book bringing together a series of case studies from Africa south of the Sahara to draw out some lessons on their utility (Nederlof, Wongtschowski, and van der Lee 2011). The term "innovation platform" means different things to different people, but most would agree that such platforms represent a physical or virtual forum that brings together different stakeholders for joint learning and action. Innovation networks are also in vogue, and represent looser associations of stakeholders but still with the goal of catalyzing innovation. In the case study presented here, neither the stakeholders nor the facilitators consciously defined their activities as being part of a formal innovation platform. Yet, innovation capacity was certainly built and sustained through interactions among key stakeholders. Establishment of formal innovation platforms can raise expectations which are hard to meet and, in our experience, can soak up stakeholders' time in diffuse meetings without concrete actions emerging. The current case suggests that an alternative approach to catalyzing innovation through ad hoc interactions among essential actors for specific purposes may be an alternative and less cumbersome means of stimulating innovation and may yield changes on the ground before expectations have been raised through convening of a formal platform with all the fanfare that involves. Further work to compare the utility of formalized platforms and looser networks would be useful (for some preliminary discussion on this see Ayele et al. 2012).

The district extension office actively promoted the formation of farmer clubs for forage and cattle production (that is, farmer interest groups) to facilitate interactions with farmers, maximizing learning among farmers and farmer clubs through cross-visits, field days, and training. Each club had only a small number of members (rarely more than 20–30 members within a village

or cluster of neighboring villages) and was self-regulated and managed—attributes that have been recognized as being important for farmer organizations (Markelova et al. 2009). Researchers supported cattle development through participatory research with selected farmer clubs, provision of information, and training, but their overall input into the innovation process reduced over time. Although farmer clubs were self-regulated and managed, they were formally recognized by the government and provided an opportunity for collective action and representation on local government forums. Initially, farmer clubs concentrated on production issues but, toward the end of the ten-year period of this case study, several farmer clubs had signed contracts with large traders from urban markets to supply groups of cattle on a regular basis. While collective action was not essential for accessing urban markets, as is the case for high-value products (for example, Kaganzi et al. 2009), it offered farmers certainty of demand and prices, and provided an additional linkage to urban markets and traders.

Once traders were linked to urban markets, feedback on the growing urban market demand for larger, heavier animals of a younger age catalyzed considerable changes to the production systems that required changes in breeds, AI, animal health, and other input services. Government provided transitional support for some of these services such as AI and animal health, but within a short period most of the services were provided by new, previously nonexistent, private-sector suppliers. The rapid change to crossbred animals has, to some extent, led to an ad hoc use of semen of different exotic breeds and there is an urgent need for a more sustainable breeding strategy, which requires capacity development and engagement of local government and private service providers (Rege et al. 2011). This example illustrates that the change process is not and may never be completed, requiring continued investment by and capacity strengthening of local stakeholders. The well-established linkage between local stakeholders in Ea Kar and researchers at Tay Nguyen University will be a sound basis for continued scientific support to the innovation process.

The rapid changes observed in Ea Kar had not taken place elsewhere despite interest by traders and local government to "export" Ea Kar's livestock development to neighboring districts (Khanh et al. 2011b). While some farmers in nearby areas had started to grow forages on their own farms based on what they had seen in Ea Kar, this had not resulted in widespread cattle development. Up-scaling needed to be supported through similar processes to those in Ea Kar, such as coalition-building and strengthening the capacity of local stakeholders, but made simpler and more rapid by having a convincing

example in Ea Kar that showed that it was possible for comparable smallholder farm families to produce high-quality cattle competitively.

Conclusion

The key to successful smallholder cattle intensification in Ea Kar was the combination of (1) a convincing innovation—farm-grown fodder—that provided early benefits and a vision for farmers, traders, and local government; with (2) a participatory, systems-oriented innovation process, which took into account both production and marketing constraints and opportunities; (3) an emphasis on strengthening capacity of key stakeholders; and importantly (4) was locally owned and managed by a loosely structured coalition for cattle development. This example also illustrates the need for a sufficiently long time period to ensure that innovation processes are able to continue without external support. The development processes described in this study demonstrated the importance of coalition-building, but also the need for a stimulus for coalition formation, which, in this case, was provided by a promising intervention. The study also showed the need for a systems-oriented view that addressed important issues in the beef value chain as they emerged and for linking farmers to market actors to facilitate information flows and feedback mechanisms. Finally, the study showed the importance of building capacity of local stakeholders to facilitate and manage the innovation processes and so sustain the development effort.

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