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Thai – Argentina Beef Development Programme

1. Background

1.1. Beef situation

Beef rearing is a major supplementary occupation of large numbers farmers with total value above 65 billion baht. Numbers of rural farm family involved beef production were more than 1.03 million. In the past, purposes of cattle keeping were for agricultural work and household assets and supplementary income from selling of old age animals. Today, due to the increased demand for consumption beef, purpose of cattle production shifted to supply beef to the markets. Specific cattle farming for high quality beef production was widely practiced under continue support of the government and development organizations.

The livestock statistics 2011, reported numbers of beef cattle in Thailand totally 6.58 million heads. Out of which, 1.59 were reproductive cows and heifers with potential to produce 0.87 heads of calves per year (55 percent calving rate). This indicated inefficient productivity of Thai beef cattle caused by numbers of constraints. Beef farmers in Thailand were lacking practical knowledge on proper care for animals, lack of good fodder to satisfy nutrient requirement, lack of high genetic performance breeders, faced problems of disease outbreak i.e. Foot and Mouth disease, internal parasite etc., were consequences to low beef productivity. During the last decade, demand for high quality beef for domestic and foreign consumers in the ASEAN markets has increased substantially. However, Thailand had not gained benefit from this emerging opportunity since beef productivity of the country was limited. The opening market for free goods movement under AFTA agreement since 1 January 2010 was another opportunity for Thai beef exporting. Following AFTA, numbers of live cattle exported were increased from 74,480 heads, with a value of 549.17 million baht in 2008 to 254,601 heads, with a value of 1,448.60 million baht in 2010, respectively. However, Thailand had imported approximately 3,000 tons of premium grade beef, with a value of 620 million baht per year.

During 2007-2009, Thai beef price depreciation had caused numbers of farmers shifted to crop production to sustain household earning. Fallow lands had turned to crops and resulted in shortage of grazing lands to hold cattle. Large numbers of beef farms included smallholders were permanently close down and sold out animals with low price. Large numbers of female cattle were slaughtered resulted in the rapid decreased of breeding animals. In 2011, numbers of reproductive cows were 1.59 million heads, compared to the previous numbers of 3.25 million heads in 2007, caused economic loss of approximately 33, 400 million baht.

The largest beef population were found in the Northeastern with 3,307,783 heads (50.2 percent), Central 1,330,375 heads (20.2 percent), Northern 1,210,243 heads (18.4 percent) and the Southern 734,705 heads (11.2 percent), respectively. Nakorn Ratchasima, Srisaket, Ubon Ratchathanee, Surin and Kanchanaburi were the largest beef producing provinces in Thailand, respectively.

The classification of beef cattle in Thailand by production stage consisted of 1.96 million heads of bulls (29.7 percent), 4.62 million cows (70.3 percent), The annual beef productivity of Thailand was estimated to 0.87 million heads per year (55 percent). Numbers of beef fattening in Thailand was 9,092 farms with 103,332 heads of fattening beef.

1.2 Beef breeds

Two major beef breed groups in Thailand were the following.

1. Tropical beef breeds

1) Native and crossbred. The total number of Thai natives and crossbred beef in Thailand were 4.65 million heads, accounted for 70.6 percent of the total beef population.

2) Brahman and crossbred. Numbers of Brahman and their crossbred were 1.78 million heads (27.1 percent).

2. Exotic purebred and crossbred

Numbers of Exotic beef breeds and their crossbred were 0.15 million heads (2.3 percent). Important exotic breeds found in Thailand were Chalolaise, Angus and their new selected breeds such as Tak, Kampangsaen, Kabinburi and Brangus etc.

1.3 Forage production

The livestock statistics 2011, reported total areas of forage crops in Thailand were 1.87 million rai (0.3 million hectare) and another 3.15 million rai (0.5 million hectare) of communal pasture land available for grazing.

1.4 Beef production systems

Beef production in Thailand classified into 2 major systems.

1. Commercial beef production

The commercial beef production of intensive farms in Thailand produced high quality beef from exotic and pure breed animals under intensive management, high investment on housing and facility, intensive forage production and balance ration feeding as well as intensive health care. The department of Livestock Development reported numbers of commercial fattening beef in 2011 were 103,332 heads from 9,092 farms, accounted for 1.0 and 1.5 percent of total, respectively.

2. Extensive beef production

The extensive beef production system was practiced by rural farm families. General characteristics of the systems were including the small scale with small numbers of animals, low intensity grazing animals on public lands or communal pasture with supplementary of crop waste or seasonal grazing on paddy and crop lands after the crop harvesting. Most of the extensive beef were free grazing where low quality native grass and crop waste were major feed of the countries. Numbers of beef cattle under extensive crop-livestock mixed farming systems were 6.48 million heads (99.0 percent) with 1.26 beef production families (98.5 percent).

1.5 Beef processing

1. The total numbers of beef slaughter units in Thailand were 846 units included 2 commercial scale and 526 (62 percent) registered slaughter units.

2. There were totally 81 beef processing units in Thailand included 9 beef processing, 72 meat ball factories, with additionally 103 tanning factories and 8 bone meal factories.

1.6 Beef marketing

Live animal market

The Department of Livestock Department reported numbers of Live cattle and buffalo markets in Thailand in 2011 were 178 units, The Live cattle markets classified by

location were 104 in the Northeastern, 54 in the Northern, 18 in the Central and 2 units in the Southern.

Beef market

The Thai beef markets classified into 3 categories.

- 1) General markets of local beef and low quality beef.
- 2) Upgrading beef markets of large beef suppliers such as local supermarkets, local beef traders, and large provincial beef markets.
- 3) Premium beef markets supplied premium quality beef for specific consumer groups such as western restaurants, hotels, steakhouse, supermarkets and modern trade beef suppliers.

1.7 Cattle price

Price of beef cattle in Thailand depends on quality.

1. Breeding animals. Price of breeding animals depending on

- 1) Animal physical performance. The animals with good physical and production characteristics such as body size and structure, skin color etc., received higher price.
- 2) Age. Younger animals have higher price per kg body weight.
- 3) Pedigree. Animals with pedigree usually offered higher price.

2. Slaughtering animals. Price of beef cattle for slaughtering depend on

- 1) Seasonal beef supply.
- 2) Size and body frame. Larger body frame animals were more favorable.
- 3) Beef yield. The higher meat yield animals were advantage over thin animals.

1.8 Beef consumption

The Department of Livestock Development estimated annual beef consumption of the country from numbers of factors including numbers of animals slaughtered each year, average live weight of animals, estimated carcass weight of 50-58 percent and red meat yield of 80-85 percent of carcass weight (40-46 percent of live weight).

However, the annual beef consumption officially reported was relatively lower than the actual consumption, due to illegal slaughtering and illegal imported animals from neighboring countries. While official estimated slaughtered beef cattle in 2011 were 620,245 heads, but actual beef slaughtered throughout the year was estimated to 992,723 heads and estimated total beef produced was 142,952 tons per year. Total beef imported to Thailand was 12,104 tons and the export volume was 9,069 tons. The total beef consumption in Thailand in 2011 was estimated to compose of 53.5 percent local beef, 44.2 percent moderate quality beef and 2.3 percent of premium beef. The average per capita beef consumption in Thailand was 2.28 kg per year, relatively very low compared to other developing countries. There were numbers of meat resources for Thai consumers such as fish, pork, chicken, most of which were cheaper than beef.

1.9 Beef price

Beef price in Thai markets depends highly on quality. High quality feedlotting beef has many times costly over general local beef. Factors used in the beef price setting are:

1. Breeds. Price of exotic breed animals such as Charolaise, Limousine, and Simmental are higher than local breeds due to better quality.
2. Age. Young cattle relatively advantage over older animals from tender meat.
3. Fattening. The feedlot fattening beef give better quality and higher price.

4. Cutting. Different cuttings of beef have different quality and price i.e. Tenderloin, Loin, T-bone have higher price over Round, Chuck, Shank, Flank and Brisket, respectively.

1.10 Beef products

1. Beef products. Beef products in Thailand are meat ball, beef sausage and canned beef were less favored compared with fresh cuttings.

2. Cattle skin. The tanning industry in Thailand produced approximately 45,000 tons of leather products. However, the domestic leather products accounted for 30% of total leather requirement each year. The Department of Revenue reported the imported of cattle and buffalo skin in 2010 was totally 136,775 tons with value of 15,462.62 million baht. Cattle skin quality in Thailand was relatively lower than imported skins due to following factors: (1) Size of Thai cattle skin was relatively small. (2) Thai labors were lacking experience in skin cutting. (3) The external parasite and skin disease caused damage to pre-slaughter skin. (4) Skin preservation and tanning technique were not properly operated.

3. Bone and horn. Bone and horn are by-products of cattle and buffalo slaughtering. The Department of Livestock Department reported the total bone productivity of cattle was accounted for 9.5 percent of live weight cattle. Bone was a raw material in many livestock industries such as ossein, gelatin, bone meal, and fertilizer etc. However, after the outbreak of the BSE, the world bone exporting was depreciated substantially. Consequently, domestic bone products were mainly contributed to fertilizing sector, while cattle horns were use on art and crafts, decoration, garments and accessory parts.

1.11 Import and Export

Import

The total import live cattle to Thailand has substantially increased during the last decade due to the favorable price. The major source of live cattle being imported to Thailand was Myanmar. Total numbers of live cattle imported to Thailand in 2010 were 26,481 heads. While the imported of 3,965 tons of frozen beef and 2,886.8 tons of intestine were reports. Major export of beef and edible parts to Thailand were Australia, New Zealand and the United States and Argentina. In 2011, Thailand has imported higher numbers and volume of beef included 53,590 heads of live animals 12,104 tons of frozen beef and 3,261 tons of intestines.

Export

The export of beef from Thailand had decreased substantially. In 2010, Thailand exported 254,601 heads of live cattle, 1,438 tons of beef products and 46,078 tons of skins. In 2011, the exported live cattle reduced to 110,381 heads, 9,069 tons of beef products and 38,815 tons of skins. Major Thai beef markets were Malaysia, Cambodia, Vietnam and China.

2. Constraints of beef development

2.1 Production

2.1.1 Numbers of beef farmers were reducing. During the last 5 years (2007-2011) numbers of Thai farmers who keep cattle and buffalo were reduced substantially due to multiple factors such as lack of land, lack of labor, less productivity and less return and fluctuate of price etc.

2.1.2 Low productivity. Due to the 2011 statistics, there were totally 6.58 million heads of cattle in Thailand, of which 1.96 were bulls and 4.62 million were female. Out of 1.59 fertility age cows, 0.87 million of calves were produced which accounted for 55 percent of total cows.

This indicated the relatively low productivity of Thai beef production. Factors related to the beef productivity of the country were:

1) **Knowledge of farmer.** Most of the beef farmers in Thailand 99.0 percent were smallholders with primary education and lacking knowledge and skill in husbandry and health care of animals. As a consequent, the less adaption of technology resulted to unpredictable productivity.

2) **Dairy breeds.** In 2011, it was reported that only 29.4 percent of beef breeds in Thailand were crossbred animals with rests 70.6 percent being native low performance cattle. The upgrading breeding programs as well as the AI service were not accessible by large numbers of beef farmers. Numbers of high performance beef animals under feedlotting farms were relatively very small.

3) **Slaughtering of female and pregnant animals for beef** reduced numbers of breeding animals.

4) **Forage availability.** Forage insufficiency has been a classical constraint to beef productivity in Thailand. Due to the increased use of land for crops production i.e. rice, sugar cane, cassava, rubber tree, oil palm etc. with more attractive price and lacking pasture irrigation systems; lacking knowledge on forage preservation; the forage shortage was a classical constraint of the beef productivity throughout the country.

5) **Disease control.** Inefficient disease control was a classical constraint in Thailand, particularly for rural small holder farms where access to vaccine and health care were limited. The poor sanitation and disease prevention were often observed as well as high mortality of calves due to internal parasites.

6) **Financial constraint.** The smallholder beef farmers cannot improve farms facility nor increase breeding animals, mostly due to lacking financial sources. Low interest loan was not accessible by beef farmers. Financial limitation was a major constraint in commercialized of beef farm in Thailand.

2.2 Processing

1. Nonstandard slaughtering. Most cattle slaughter was operated by nonstandard slaughter houses. Numbers of standard certified slaughter house were limited and insufficient.

2. Smuggling slaughtering. The illegal smuggling slaughtering of beef were still existed in the remote areas of Thailand.

3. Skin quality. Due to unskillful cutting, slaughtering and improper skin preservation, skin quality of Thai cattle was not meet the industrial standard.

4. Beef process. The processing of beef to value added products were limited.

2.3 Market

Live animals

1.) Most of the beef owners (99.0 percent) in Thailand are individual small holders. These small holders should organize into groups or network to increase.

2.) Farmer were lacking marketing and price information.

3.) The enforcement of regulation and control on animal movement made difficulty to market access.

4.) The control over exporting of live animals depressed market interest.

5.) The application of traceability of beef animals in Thailand was not fully feasible.

Beef

- 1.) The practice of un-sanitize slaughtering depressed consumer confident on beef products.
- 2.) The Thai consumers were unaware of beef quality due to lacking information.
- 3.) Due to the denied on beef quality, 40% of moderate to high quality cuts of beef was sold in lower price.
- 4.) The research to encourage used of second grade beef had not been performed.
- 5.) The development of high-end market for value added beef has not been encouraged.

2.4 Policy

- 1) The national beef policy was frequently changing over time and lack of continuity.
- 2) The lacking of private and stakeholder participation in policy development led to the poor performance in beef development projects.
- 3) Numbers of acts and regulations were not updating and disadvantage for beef development such as the livestock act 1939 indicated that cattle are draft animals, while recently non beef cattle are keeping for draft purpose but for beef instead. The livestock act 1992, did not allow livestock officers inspecting carcass transportation vehicles etc.

3. Strength and opportunity in beef development

Strength

1. The smallholder beef owners use family labors on beef rearing. This minimizes production cost.
2. Availability roughage, crop waste and agro-industrial waste such as corn and sorghum stems, cassava waste, pineapple waste, legume stems and fruit waste from fruit industry were cheap feed resources for beef production.
3. Thailand is free of BSE disease.
4. Quality of beef in Thailand was highly demand by local consumers. Particularly native beef and grass feeding beef were favored by Thai consumers due to their special taste. Large scale farms can earn extra income from beef fattening and producing high quality beef for premium markets. Numbers of beef cooperatives were formed in Thailand to produce and supply high quality feedlotting beef.
5. The related institutions had developed practical technology on beef breeding, beef feeding and animals health as well as processing beef products substantially.

Opportunity

1. Beef is highly demand by Islamic countries as well as Thai Muslim consumers.
2. Thai food is famous and widely accepted by global customers. The opportunity to export ready to eat products was widely opened.
3. The encouraging of new branding of Thai beef such as native beef with small carcass and special beef production such as organic or natural beef.
4. Some progress beef farms in Thailand had already developed model beef production systems and produce premium quality of grain fed beef.
5. The demand for high quality beef and beef products in Thailand was continuously increased. Large numbers of tourists as well as domestic consumers gained interest on quality beef over low quality beef.

6. The involvement and agreement of Asian Free Trade will facilitate and increase potential in exporting beef to the Regional markets.

7. The demand for quality beef of the neighboring countries were substantially improved while exporting potential of Thai beef was gradually appreciating as a result of the regional economic growth.

4. Weakness and threat in beef development

Weakness

1. Large numbers of beef owners were old age, primary educated smallholders. Late adoption of innovation was a significant characteristic of this group.

2. The farmers were not interest in group forming. This made difficult for service provision, quality control and supply chain planning as well as weak linking with markets and consumers.

3. The outbreak of bovine disease such as foot and mouth disease was seldom occurred in Thailand and being a limiting factor of live cattle exporting.

4. Insufficient of good quality forage crop was a crucial constraint of cattle feeding. Unplanned of land use and absent of irrigation systems are major determinants of forage shortage.

5. Initial investment on beef production was relatively high, while production period was rather long. Farmers will hardly earn benefit if depends on high interest loan.

6. Numbers of breeding cows were substantially reduced to scarce level.

7. The good trading systems were hardly practice in cattle markets. Cattle price was not related with meat quality.

8. The slaughterhouses were under sanitation acceptant.

9. Bovine diseases such as FMD, Hemorrhagic septicemia, Brucellosis seldom occurred.

10. Laws and regulations regarding animal movement controls were limiting factors to cattle marketing.

11. The practice of post-harvest of beef animals such as cutting, preserving, curing and processing were poorly managed.

12. The processing of beef to added value products was not widely practice due to limiting of innovation.

13. Lacking incentive and promotion program to increase beef consumption.

Threats

1. Consumers preference on beef was relatively low compared to other meats. Some people were vegetarian or non-beef eating. A numbers of consumers preferred imported beef over domestic beef.

2. Thai consumers are accessible to various sources of meats such as chicken, pork as well as natural sources like fish and shrimp etc.

3. The competition of beef in oversea markets tends to be stronger due to large investment in major beef market in Southeast Asia and Middle East. Export beef from Thailand hardly can compete with lower cost beef from Australia etc.

4. The free movement of within the region beef products without tax barrier due to the free trade agreement, will resulted in increasing quantity of beef from Australia, New Zealand and India entering Thai markets.

5. The illegal smuggling of live animals from neighboring country was remaining occurred.
6. Disease and disaster were seldom occurred.

5. Overall goal and specific objectives

Overall goal and specific objective of the programme was to improve beef productivities through the introduction of proper feeding management to smallholder farms.

6. Objectives

The major constraint of beef cattle in Thailand was the insufficient feed due to improper feeding management. The reluctant to establish pasture, poor pasture management, insufficient or lacking of forage preservation, lacking knowledge on utilization of crop waste and lacking protein supplementation are all consequence to low productivity of beef cattle. The good practice in pasture establishment, proper feeding management, good forage preservation and sound practice in crop waste utilization were required in order to improve production efficiency of beef rearing in Thailand. Additionally, the skills and knowledge on cow-calf management, proper heifer and mature cows management must be applied to enhance productivity and increase economic value.

Although Thailand, particularly the Department of Livestock Development has provided annual budget and implemented numbers of projects to accelerate beef production of the country continuously. But during the last few years, the DLD had gained tremendous experience and knowledge on beef management from the Thai-Argentina collaboration program. Following the intensive training course on holistic research and development in Argentina for the year of 2016 – 2018, the Thai-Argentina partners had planned to design the Beef Feeding Systems to enhance feeding efficiency and productivity of beef animals in Thailand.

Specific objectives of the programme were:

- 1.) To design the suitable cow-calf systems for Thailand.
- 2.) To establish Suitable Beef Cow-Calf Demonstration farms (SBCD).
- 3.) To establish Suitable Beef Cow-Calf Model farms (SBCM).
- 4.) To provide capacity building and extension services to smallholder beef farms in Thailand.
- 5.) To increase beef productivities.

7. Targets

The programme targets were:

- 1) Develop suitable cow-calf systems for Thailand.
- 2) Established 8 SBCD farms on 8 DLD Animal Nutrition Research and Development Centers/Stations.
- 3) Established 12 SBCM on 12 participation beef farms in 3 provinces.
- 4) Provide training on efficient beef husbandry and feeding management to beef farmers and technical officers.
- 5) Provide extension services on beef husbandry and feeding management to smallholder beef farms.

8. Indicators

Indicators of the programme were:

- 1) Improvement of cow fertility and calving rates by 20 percent.
- 2) Improvement of beef productivity of SBCD and SBCM by 20 percent.
- 3) Numbers of beef farmers accessed capacity building and beef extension services.
- 4) Numbers of farms adopted, practice and accomplished good cow-calve systems.
- 5) Improved beef productivity.

9. Activities and implementation

The Thai Argentina Beef Development Programme implementation was assigned according to the following 3 components:

Component 1: Capacity building project

Component 2: Suitable Beef Cow-Calf Systems (SBCS) design and implementation project

Component 3: Beef feeding management and nutrition extension project

Component 1: Capacity building project

Objective: To enhance academic and technical knowledge and experience of Thai and Argentina livestock officers on sound feeding management and nutrition of beef animals.

Activities:

- 1) Support the exchange of knowledge and experience of Thai and Argentina nutritionist and livestock officers through organizing field visits to Argentina (for Thai technicians) and technical field visits in Thailand (for Argentina experts) annually.
- 2) Produce technical manuals and guidelines on beef husbandry, nutrition and feeding management through Thai Argentina collaboration.
- 3) Produce and exchange data and information on beef management, supply chain, value added etc. and disseminate through joint website.
- 4) Establish a Thai Argentina Beef Network (TABN).

Component 2: Suitable Cow-Calf Systems design and implementation project

Objective: To design suitable Cow-Calf systems suitable for Thailand and neighboring countries and demonstration of the systems on farms.

Activities:

- 1) Design Suitable Beef Cow-Calf System (SBCS) suitable for Thailand and neighboring countries through Thai-Argentina collaboration.
- 2) Establish Suitable Beef Cow-Calf Demonstration Farms (SBCD) to demonstrate and disseminate technology of high efficiency beef production systems. Targets of the activities showed in the following table.
- 3) Establish Suitable Beef Cow-Calf Model Farms (SBCM) to demonstrate and disseminate technology of high efficiency beef production systems at the farm

level where smallholder beef farmers were participated and implemented the sound beef production systems on farms. The model farms are learning centers and provide farm-to-farm technology transfer service. Targets of the activities showed in the following table.

Table 1 Suitable Beef Cow-Calf Demonstration farms (SBCD)

<i>Research station</i>	<i>No. of farm</i>	<i>No. Of cattle</i>	<i>Pasture area, rai</i>	<i>Concentrate feed, kg</i>
Nakornratchasima	1	20	4	9,600
Petchaboon	1	20	4	9,600
Supanburi	1	20	4	9,600
Sukhothai	1	20	4	9,600
Loei	1	20	4	9,600
Udonthani	1	20	4	9,600
Roi Et	1	20	4	9,600
Kalasin	1	20	4	9,600
Total	8	160	32	76,800

Table 2 Suitable Beef Cow-Calf Model Farms (SBCM)

<i>Location (province)</i>	<i>No. of farm</i>	<i>No. Of cattle</i>	<i>Pasture area, rai</i>	<i>Concentrate feed, kg</i>
Nakornratchasima	4	40	8	19,200
Petchaboon	4	40	8	19,200
Supanburi	4	40	8	19,200
Total	12	120	24	57,600

Description of beef demonstration farms:

- Establish demonstration farms in DLD (government) Animal Nutrition Research and Development Centers/Stations locate in various location in Thailand include the North (Petchaboon and Sukhothai provinces), Central (Supanburi province) and Northeast (Nakornratchasima, Loei, Udonthani, Roi Et and Kalasin province).
- The demonstration farms assigned to perform the following technology demonstration:
 - Good beef breeding systems with 20 cows and 1 bull
 - Good housing systems
 - Good pasture production and utilization
 - Good pasture conservation and preservation
 - Good environmental friendly systems
 - Good energy conservation i.e. biogas production from beef manure
 - Good irrigation of pasture
 - Good beef concentrate feed production and utilization
 - Suitable Beef Cow-Calf rearing and management
 - Suitable Seasonal Breeding Model
 - Practice of body scoring and application in beef herd management
 - Practice of suitable calf weaning technique

- Practice of suitable post weaning fattening
- Practice of suitable beef selling and marketing

Description of beef model farms:

- Establish beef model farms in participate smallholder beef farms in 3 locations include Petchaboon (North), Supanburi (Central) and Nakornratchasima (Northeast) provinces.
- The model farms assigned to perform the following on farm technology demonstration:
 - Good beef breeding systems with 10 cows per farm on average
 - Good housing systems
 - Good pasture production and utilization
 - Good pasture conservation and preservation
 - Good environmental friendly systems
 - Good energy conservation i.e. biogas production from beef manure
 - Good irrigation of pasture
 - Good beef concentrate feed production and utilization
 - Suitable Beef Cow-Calf rearing and management
 - Suitable Seasonal Breeding Model
 - Practice of body scoring and supplication in beef herd management
 - Practice of suitable calf weaning technique
 - Practice of suitable post weaning fattening
 - Practice of suitable beef selling and marketing
 - Practice farm recording and economic assessment

Component 3: Beef feeding management and nutrition extension project

Objective: To provide extension services on suitable beef feeding management and beef nutrition to smallholder beef farms.

Activities: Provide extension services include farm visit, training, capacity building, farm supervising, technical demonstration, farm recording, and information and data dissemination to smallholder beef farms. Targets of training and farm extension showed in below table.

Table 3 Target of the project extension

<i>Location (province)</i>	Training				Extension
	<i>Livestock officers</i>		<i>Farmers</i>		Farmers
	<i>Course</i>	<i>Participants</i>	<i>Course</i>	<i>Participants</i>	
Nakornratchasima	1	10	1	20	100
Petchaboon	1	10	1	20	100
Supanburi	1	10	1	20	100
Total	3	30	3	60	300

10. Inputs

To support the project activities Thailand and Argentina will collaborate and support the following inputs.

- 1) Academic, technical and administration staffs
- 2) Office space and equipment for project cooperation and operation.
- 3) Farm equipment
- 4) Pasture and land
- 5) Experiment animals
- 6) Demonstration farms
- 7) Smallholder participatory farms
- 8) Extension services, personnel and facility

11. Outcomes

Expected project outcomes were:

- 1) Suitable and sustainable Cow-Calf systems and beef feeding management for Thailand and applicable to neighboring countries.
- 2) Sustainable Improvement of beef productivity of smallholders.
- 3) Increase beef supply to sustain domestic beef demand.

12. Collaborate organization and counterparts

Collaborated organizations of Thailand and Argentina and project staff and counterparts showed in following table

Table 4 Project collaborate organizations

	<i>Thailand</i>	<i>Argentina</i>
Execution	Department of Livestock Development (DLD), Ministry of Agricultural and Cooperation	INTA
Cooperation	Bureau of Animal Nutrition Development (BAND), DLD, Bangkok	
Main Sites	1) Nakornratchasima ANRDC, Nakornratchsima province, Northeast Thailand 2) Petchboon ANRDC, Petchaboon province, Northern Thailand 3) Supanburi ANDS, Supanburi province, Central Thailand	
Sub Sites	1) Sukhothai ANDS 2) Loei ANDS 3) Udonthani ANDS 4) Kalasin ANDS 5) Roi Et ANDS	

Table 5 Project staff and counterparts

	<i>Thailand</i>	<i>Argentina</i>
Execution	Director General, Department of Livestock Development (DG DLD)	
Coordinators	<ol style="list-style-type: none"> 1) Director of Bureau of Animal Nutrition Development (BAND) 2) Director of Nakornratchasima Animal Nutrition and Research Development Center 	
Recent counterparts	<ol style="list-style-type: none"> 1) Wiwat Chaicha-um 2) Tongchai Posiri 3) Aswin Saichua 4) Viroj Ritruetchai 5) Ittipol Phaopaisal 6) Anuparb sengsai 	INTA
Assigned counterparts and technical staffs	<ol style="list-style-type: none"> 1) Kanokkarn 2) Nattapong 	
Project staff	<ol style="list-style-type: none"> 1) Director of Sukhothai ANDS 2) Director of Loei ANDS 3) Udonthani ANDS 4) Kalasin ANDS 5) Roi Et ANDS 	

Annex-1

Cow-Calf Calendar (Tentative)

Activities	J	F	M	A	M	J	J	A	S	O	N	D
Seasonal events												
Rainy season				A	M	J	J	A	S	O		
Rice production season					M	J	J	A	S	O	N	
Dry season	J	F	M	A							N	D
Labor availability	J	F	M	A							N	D
Beef price favorability									S	O	N	D
Pasture availability					M	J	J	A	S	O		
Cow-calf program												
Breeding season			M	A	M	J						
Calving season	J	F	M									D
Weaning season				A	M	J	J					
Marketing season									S	O	N	D

Annex-2

Pasture and feed strategies

Activities	J	F	M	A	M	J	J	A	S	O	N	D
Pasture availability, %	20	20	20	20	40	80	100	100	80	40	20	20
Pasture quality, %	20	20	20	20	40	80	100	100	100	100	80	40
Nutritional status, %	4	4	4	4	16	64	100	100	80	40	16	8
Nutrient deficiency, %	96	96	96	96	84	36	0	0	20	60	84	92
Dry matter supplement, %	80	80	80	80	60	20	0	0	20	60	80	80
Crude protein supplement, %	80	80	80	80	40	20	0	0	0	0	20	60
Kg supplement feed DM/100 kg BW	2	2	2	2	1	0.5	0	0	0.5	1	1	1
Forage kg DM/100 kg BW	1	1	1	1	1	0.5	0	0	0.5	1	1	1
Concentrate kg DM/100 kg BW	1	1	1	1	0	0	0	0	0	0	0	0
% CP concentrate	16	16	16	16	16	16	16	16	16	16	16	16

Annex-3

Recommend Feed Supplement for beef cows (kg DM per day for 200 kg cow)

<i>Month</i>	<i>200 kg BW</i>			
	<i>Grazing</i>	<i>Hay/Silage</i>	<i>Concentrate</i>	<i>Total concentrate</i>
January	1	2	2	60
February	1	2	2	60
March	1	2	2	60
April	1	2	2	60
May	2	2	0	0
June	4	1	0	0
July	5	0	0	0
August	5	0	0	0
September	4	1	0	0
October	2	2	0	0
November	2	2	0	0
December	2	2	0	0
Total concentrate, kg/cow/year				240

Annex-4

Recommend Feed Supplement for beef cows (kg DM per day for 200 kg cow)

<i>Month</i>	<i>400 kg BW</i>			
	<i>Grazing</i>	<i>Hay/Silage</i>	<i>Concentrate</i>	<i>Total concentrate</i>
January	2	4	4	120
February	2	4	4	120
March	2	4	4	120
April	2	4	4	120
May	4	4	0	0
June	8	2	0	0
July	10	0	0	0
August	10	0	0	0
September	8	2	0	0
October	4	4	0	0
November	2	4	0	0
December	2	4	0	0
Total concentrate, kg/cow/year				480