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IMPROVING THE LIVESTOCK INDUSTRY OF
NORTHEAST THAILAND: SECTOR ASSESSMENT,
STRATEGIES, AND PROJECT DESIGN

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POLITICAL TERMS AND MEASUREMENTS

Terms

Changwat	=	Province
Amphoe	=	District
Tambon	=	Sub-district
Muban	=	Village

Currency Equivalents

US\$1	=	Baht 23.00
Baht 1	=	US\$0.04

Area Equivalents

1 rai	=	0.16 hectares (1,600 m ²)
1 hectare	=	0.25 rai (2.47 acres)

ABBREVIATIONS

AI	Artificial Insemination
AH	Animal Husbandry
DOA	Department of Agriculture
DOAE	Department of Agricultural Extension
DPO	Dairy Farming Promotion Organization of Thailand
DOLD	Department of Livestock Development
EEC	European Economic Community
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GNP	Gross National Product
IBIC	International Buffalo Information Center
KKU	Khon Kaen University
KU	Kasetsart University
LDC	Livestock Development Center (Unit may have many centers)
LDP	Livestock Development Project
LDU	Livestock Development Unit (1 unit per province)
MIPO	Meat Industry Promotion Organization
MM	Man/month
MOAC	Ministry of Agriculture and Cooperatives
NBRDC	National Buffalo Research and Development Center
NELDP	Northeast Livestock Development Project
NERAD	Northeast Rainfed Agricultural Development
NESDB	National Economic and Social Development Board
NIDA	National Institute of Development Administration
NSO	National Statistical Office
RAI	Rainfed Agricultural Intensification
REGP	Rural Employment Generation Program
RTG	Royal Thai Government
UNDP	United Nations Development Program
USAID	United States Agency for International Development

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EXECUTIVE SUMMARY

The stated objective of the 1982-1986 Five-Year Plan of the Royal Thai Government is "to reduce absolute poverty and accelerate rural development in backward areas." Farmers in the rainfed areas of the Northeast (about 95 percent of arable land in that region) comprise approximately one-half of the 14 million Thais considered to live in absolute poverty. These farmers, as well as their relatively more well-to-do neighbors, largely depend on livestock as a source of food, cash income, savings (a "living bank") motive power (traction and transportation), as well as fuel, fertilizer, fiber, and wide variety of by-products, making livestock an integral part of farming operations. In essence it forms a major part of every farmer's economic base. Because livestock are so important in all Northeast farm families lives, programs to reduce absolute poverty or, alternatively, to improve their well-being, requires consideration of a livestock program.

Government has a mandate to service small farmers both by providing services and developing opportunities for this and associated private sector initiative. But, there is growing recognition that government sponsored programs need to be reexamined, reoriented and refocused in the area of livestock development to effectively reach the small farmer client. As a consequence, the livestock project in the Rainfed Agricultural Intensification (RAI) program has as its basic purpose providing support to the Department of Livestock Development (DOLD), the agency which will provide the leadership, services and educational assistance in the area of livestock production to traditional of small farm families in the Northeast.

Thailand has already made investments in public sector infrastructure for livestock development. Because of this, the strategy of the livestock project is to build on, and improve previous projects and improve current infrastructure. Recognizing that livestock production is an integrated operation comprising management, breeding, nutrition, and animal health, sub-projects have been developed in these four areas. Overall, there are 14

activities, many of which are interrelated into programs. The main thrusts of these programs are: (1) village level on-farm research and extension; (2) improvement of livestock station activities; (3) development of farmer and subject matter specialist (SMS) training; and (4) animal health improvement.

There are two DOLD institutional focal points in the Northeast: The Tha Phra livestock headquarters and associated parts of what has been known as the Northeast Livestock Development Project (NELDP), and the Tha Phra Diagnostic Laboratory and sub-regional clinics. The diagnostic laboratory and veterinary clinics will be strengthened to enable them to target their efforts at disease identification. Animal health training of SMS and farmers will be coordinated by the regional livestock headquarters at Tha Phra.

The Tha Phra regional headquarters will be administered by Thai and an American co-manager. They will direct activities of the 16 Livestock Development Unit (LDU) and 80 Livestock Development Center (LDC) personnel. At the village level, LDC personnel will work more closely with Kaset Tambon agents (extension agents from the Department of Extension). The headquarters will also help initiate and coordinate, with universities and other groups, village level studies aimed at improving integrated livestock production. They will also emphasize improvement of livestock station effectiveness and development of new communication aids for extension use.

The breed improvement strategy is to (1) improve the effectiveness of artificial insemination service to villagers and (2) expand and improve sources of high quality cattle and buffalo. The nutrition improvement strategy is to: increase forage production, (2) improve utilization of agricultural by-products and wastes and, (3) increase the efficiency of feed utilization through mineral supplementation. The animal health strategy is aimed at determining priorities for disease control, improving the diagnostic infrastructure and carrying out animal health training programs. The 14 activities and their proposed funding levels are:

Institutional Support

- | | |
|-------------------------------------------------------------------------------------------------------------|-------------|
| 1. Improvement of the Extension and Technology Role of the Original Northeast Livestock Development Project | \$1,545,000 |
| 2. Support for the National Buffalo Research and Development Center | \$450,000 |

Breeding

- | | |
|--------------------------------------------------------------------------------------|-----------|
| 1. Expansion of Improved Crossbred Bovine Breeding Stock via performance testing | \$456,000 |
| 2. Performance Testing and Management Training for Cattle in Villages | \$562,000 |
| 3. Improving the Crossbreeding of Buffalo and Cattle through Artificial Insemination | \$530,000 |
| 4. Expansion of Native Thai Breeding Stock via Performance Testing. | \$754,000 |

Nutrition

- | | |
|--------------------------------------------------------------------------------------------|-----------|
| 1. Improving Village Level Forage Production | \$180,000 |
| 2. Mineral Studies on Bovine Animals | \$195,000 |
| 3. Studies on Growing/Finishing Bovine animals on grass | \$150,000 |
| 4. Finishing Bovine Animals on Rations Containing Agricultural By-products and Local Feeds | \$140,000 |
| 5. Improving Agricultural By-products and Wastes for Use in Bovine Feeding | \$105,000 |

Health

- | | |
|--------------------------------------------------------------------------------------------------------|------------------|
| 1. Improvement of Animal Disease Monitoring and Development of a Permanent Disease Surveillance System | \$558,000 |
| 2. Strengthening Field Clinics for their Role in Disease Control | \$291,500 |
| 3. Improvement of Bovine Reproduction | <u>\$407,000</u> |
| Total, 1982 constant dollars | \$5,323,500 |

The total project cost, including 10 percent for inflation and 5 percent for contingencies, is estimated at \$9.0 million. Of this, 17 percent is for the project manager and consultants, 5 percent for vehicles, 40 percent for commodity purchase, 14 percent for participant training, and 24 percent for other items including working capital for the breeding projects.

IMPROVING THE LIVESTOCK INDUSTRY OF NORTHEAST THAILAND:
SECTOR ASSESSMENT, STRATEGIES, AND PROJECT DESIGN

PART I. AGRICULTURAL SECTOR OF THAILAND

Economic Development Trends

The agricultural sector of Thailand has displayed as much real growth as any country in the world since, in Thailand, agricultural production (in terms of gross domestic product (GDP) at constant prices) grew at an annual rate of 5 percent during 1960-80 (Table 1.1). As of 1980, agriculture contributed about 26 percent of GDP (compared to 40 percent in 1960) and 58 percent of the value of all exports (Table 1.2). Also more than 70 percent of the nation's labor force was considered to be in the agricultural sector. Because population growth rate has continued to decline, real agricultural GDP per capita has grown at 2.8 percent annually over the past 20 years.

Table 1.1. Agricultural growth rate in Thailand, 1960-1980
with targets for 1982-1986

Sub-Sector	Annual GDP growth in constant prices			
	1960-70 (%)	1970-75 (%)	1975-80 (%)	5th Plan target 1982-86 (%)
Crops	4.7	5.2	3.3	4.7
Livestock	3.5	7.6	5.5	4.2
Fisheries	20.7	4.7	- 3.1	5.4
Forestry	4.1	2.9	0.3	0.3
Agriculture	5.5	5.1	3.5	4.5

Source: World Bank, June 3, 1982, Vol. I, p. 1

Table 1.2. Agriculture's role in GDP and exports
1960-1980

	GDP (current prices)			Exports		
	Agri. (Million Baht)	Whole economy (Million Baht)	Agri. share (%)	Agri. (Million Baht)	Whole economy (Million Baht)	Agri. share (%)
1960	21.5	54.0	40	7.6	8.4	91
1970	38.5	136.1	28	10.4	14.8	70
1975	94.1	298.8	31	29.5	45.0	66
1980	176.3	673.7	26	77.6	133.0	50

Source: World Bank, June 3, 1982, Vol. II, p. 3.

The 20 year average growth rate in agriculture is impressive, but masks a decline in the rate in later years. In the 1975-80 period, only a 3.5 percent rate was obtained, primarily because of the need to bring marginal lands into production since virtually all of the potentially higher productive land has now been brought under cultivation.

The most rapid period of growth in Thailand's agriculture occurred from 1970-75 at which time real value of agricultural production increased at a phenomenal rate of 10 percent per year. During this period there was a global commodity boom which led to high demand for Thai agricultural products, and prices that were significantly higher than any other period.

The Royal Thai Government (RTG) Fifth Development Plan covering 1982-86 projects an annual agricultural growth rate of 4.5 percent. In contrast, the whole economy is targeted to grow at 6.6 percent annually. It is apparent that meeting agricultural growth targets will require considerable

intensification in production methods, especially in some areas such as the Northeast which have lagged behind the country as a whole. A recent World Bank report (June 3, 1982) indicates that it is doubtful whether the RTG target of 4.5 percent annual growth can be achieved. Rather, they project a rate of 4.1 percent in the first half of the 1980's, and 4.3 percent in the last half of the decade. The Bank notes that in the rainfed area diffusion of research results will be one of the major factors in achieving the targets.

A principal factor in Thailand's rapid agricultural growth has been the availability of export markets although, as shown in Table 1.2, agricultural exports declined from 91 percent of the economy's exports in 1960, to 58 percent in 1980. In reality, this is a healthy change which is part of Thailand's move toward industrialization.

A further striking trend is the diversification that has taken place in agricultural exports. For example, the two traditional export products, rice and rubber, accounted for only 46 percent of agricultural exports in 1979 compared with 66 percent in 1962 (Table 1.3). The crops which expanded most in the 1960's and early 1970's were maize, cassava, and sugar. In the early 1970's exports of shrimp and canned pineapple also increased dramatically.

By the late 1970's rice exports had increased sharply, recording an annual growth rate of about 22 percent largely due to increased production on irrigated land during the dry season. But, while rice exports were increasing, the earlier high growth crops such as maize and sugarcane began to decline. It appears that in the early 1980's cassava exports may decline due to reduced demand in the EEC, Thailand's principal market. Currently, rice, rubber and cassava account for over 60 percent of agricultural exports.

Table 1.3. Thailand's agricultural exports
1962-1969

Commodity	Annual rate of growth in export volume			Share of total agricultural exports			
	1962-70 (%)	1970-75 (%)	1975-79 (%)	1963 (%)	1970 (%)	1975 (%)	1979 (%)
Rice	-5.1	-7.6	21.6	4.0	24	19	26
Rubber	4.8	4.7	11.3	26	21	11	20
Maize	12.4	6.5	-2.9	6	18	18	9
Cassava	12.7	17.2	16.6	5	11	15	16
Sugar	-8.2	50.1	-2.9	2	1	18	8
Tobacco	15.1	7.4	20.3	-	2	2	2
Mungbeans	n.a.	6.7	23.6	-	2	1	2
Shrimp	-	19.9	6.8	-	2	3	4
Canned Pine-apples	-	48.7	34.0	-	-	1	2
Other	n.a.	n.a.	n.a.	21	19	12	11

Source: World Bank, June 3, 1982, Vol. II, p. 6

Employment data are difficult to compare due to differences in definitions and seasonal coverage. Nevertheless, available data indicate that while agricultural employment grew at an annual rate of 1.7 percent from 1960 to 1970, and 1.9 percent from 1970 to 1977/78, non-agricultural employment grew much faster, 3.9 and 6.5 percent respectively, for these two periods (Table 1.4). It also appears that the expansion of agriculture to new lands probably provided the greatest new source of agricultural employment in the 1960's and through the early 1970's since total farm land doubled from about 9.9 million hectares in 1959/60, to 18.4 million hectares in 1977/78. The average increase of about 490,000 hectares annually during this early period probably absorbed about 80,000 new families per year, thus

accounting for virtually all of the increased employment. By the 1970's, new lands were only opened up at the rate of about 450,000 hectares annually. Furthermore, because the added farming took place in remote areas or on marginal lands, it is estimated that only about 60,000 new farm families were added per year.

The data in Table 1.4 refer to the main agricultural season (July - September) rather than the January - March off-season, and thus ignore seasonal "unemployment". They also tend to exaggerate the importance of agriculture as a provider of full time jobs. Nevertheless, it appears that agricultural employment was better distributed in the late 1970's than at the decade's beginning as one study shows the off-season rate of under-employment to be 44 percent in 1970 compared with 35 percent in 1977/78 (World Bank, June 3, 1982, Vol. II, pp. 11). This is reasonable, however, considering the increase in double cropping of rice and multiple cropping in the maize areas.

Table 1.4. Thailand's agricultural and non-agricultural employment, 1960 - 1977/1978

	Total employment			Average annual growth	
	1960	1970	1977/78	1960-70	1970-78
	(million)			(%)	(%)
Agriculture	11.3	13.4	15.4	1.7	1.9
Non-Agriculture	<u>2.4</u>	<u>3.5</u>	<u>5.6</u>	<u>3.9</u>	<u>6.5</u>
Total	13.7	16.9	21.0	2.1	2.9
Agriculture's					
Share of Total	82%	79%	73%		

Source: World Bank, June 3, 1982, Vol. II, p. 6

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Political and Private Sector Trends

Private sector initiatives have largely been responsible for the spectacular agricultural growth of Thailand. Most successful ventures have come about as a result of an outward looking private trading subsector which recognized potential export possibilities when they have arisen. For example, in the 1960's, the private sector recognized the export possibilities for maize and kenaf and promoted their production. In the 1970's the private sector quickly switched to cassava from kenaf. The world sugar boom of 1973-75 was also correctly anticipated. The private sector initiatives have been successful because Thailand has a relatively free economy. Ironically, an element of success has been due to Government's relatively inefficient enforcement of numerous existing regulations such as those governing expansion of cassava and sugar processing.

By all measures, the private sector has played the dominant role in expansion of export related crops. Naturally, there has generally been a strong interdependence of the private sector and Government in providing the prerequisite for yield improvements and technology transfer. Unfortunately, the complementarity has been rather unplanned due, largely, to mistrust of each party with the other. This is especially unfortunate for domestic oriented agricultural commodities, as a delicate balance exists between supply and demand. Thus, for example, if a Government thrust program is especially successful in yield improvement and rapid adoption takes place, prices can plummet thus causing a disaster in the industry. This problem is especially worthy of note as Thailand is forced to move toward a more intensified agriculture as a result of severely limited opportunities for landholding expansion. The net result is that the private sector will increasingly look toward government for information and experience about relevant technologies. This service will be expensive, and it is not likely to be provided to any great degree by the private sector. This is especially true for the rainfed areas of the Northeast, a region that is characterized by high weather risks, low fertility soils, and a subsistence agricultural orientation of its farmers.

A recent World Bank report (June 3, 1982, Vol. II, p. 24) gives a synopsis of the critical initiatives which will be necessary from a political viewpoint, i.e., one involving a coordinated role of government and private sector:

- (a) The reversal of policies which hamper the expansion of yield improving/intensification activities. This requires a focus on (1) pricing, marketing and regulation policies affecting both output and inputs; and (2) land tenure and land development policies affecting the incentives for land improvement; and
- (b) The improvement, in a coordinated manner, of priority support services and programs which can bring about increased intensification and yields. This requires a focus on the development and implementation of an input package (improved seeds, fertilizer, pesticides, improved cropping techniques) for food, feed and fiber which maximize the complementary impact of the private and public sectors.

It appears that radical changes are taking place in the government/private sector roles, with increased emphasis being placed on private sector involvement. This trend is widely expoused by top Government officials but, as usually happens, changes are rather slow in coming about due to a well-entrenched middle level bureaucracy which resists changes in roles and responsibilities. Despite these obstacles Government, in its Fifth Development Plan (1982-86), recognized the need for increased stimulation of the agricultural sector, especially in the Northeast, and has identified a number of programs to meet the target of 4.5 percent annual output increase which is designed to provide both economic growth and increased equity. In effect, since agricultural poverty areas of the Northeast tend to be inadequately served by the private sector, they will require more concentrated government assistance in services, inputs, and planning.

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Potential of the Agricultural Sector

Agricultural Product Demand

The domestic and export market prospects for Thailand's major agricultural products is generally considered good except for sugar and, possibly, rice. The prospect for cassava is uncertain due to the effects of the worldwide recession; and decreased demand for it as an animal feed in the EEC. However, due to Thailand's comparative advantage compared with many other exporting countries, and its type of products, export market outlets should not be a major impediment to sustained agricultural growth. Apart from sugar and rice, supply rather than demand is likely to be the limiting factor for agricultural crops.

Agricultural Product Supply

It appears that future growth in agricultural commodity output will have to come about mainly from increased yields brought about through intensification of agricultural activities and shifts between activities and commodities, as the era of rapid agricultural growth based on expansion of farm holdings is virtually over. The net result is market forces will place increasing pressure on farmers to use more yield-improving technology which implies greater use of purchased inputs such as fertilizer and biocides, as well as longer-term investments in mechanized farm implements such as tractors. Furthermore, there will be pressure by Government to increase yields in an effort to meet low price food and fiber policies for domestic consumers, and ever greater exports to provide foreign exchange.

Agricultural growth will continue to be essential for improvements in employment and incomes for the foreseeable future. Because of Thailand's rapid industrialization and urban growth, agriculture will contribute proportionately less to total employment than in the past although agricultural production growth rates will be approximately equal to 1970's.

This is because of some parts of agriculture being more intensified and thus being more capital intensive, while other segments such as those moving to double cropping will require more full time labor. Underemployment of adults will decline through this process. Also, now that education is compulsory through the sixth grade, and considerable emphasis is being placed by even the poorest farm families on high school education if possible, there will continue to be a dramatic decline in the underemployment of children. Despite these beneficial factors, it is unlikely the non-agricultural sector will be able to absorb all agricultural sector related surplus labor. This surplus labor, plus the lack of new land for agricultural expansion means increased pressure to fragment existing land holdings.

The 1980's will witness a greater burden on Thailand's agriculture than in memorable history as income expectations continue to grow rapidly, land scarcity develops, and prices of agricultural commodities come under increasing pressure in both domestic and world markets. The net result is alleviation of poverty in the 376 districts designated by Government for programs will have to take place through increased productivity.

Government has moved toward a policy of restraining its investment activities with emphasis being placed on improving the quality of resources already committed to the agricultural sector as well as management of those resources. The expectation is thus that new large programs such as irrigation will not be forthcoming, but rather that measures which will allow the sector to function more efficiently and effectively will be needed. A number of policy changes have taken place, but some pricing and regulatory policies are still in force which serve to depress farm level prices, or increase input and marketing costs. For example, export taxes for rice and rubber are still equivalent to a taxation rate of 25 percent and 22 percent respectively of on-farm prices. Fertilizer costs are unduly

high because domestic fertilizer companies are protected and only limited mixes are available, even at controlled prices. Use of fertilizers by Thai farmers is among the lowest in Asia.

Another constraint to increased productivity through intensification is inadequate security of tenure due to a very confused tenure situation. This is because only about 6 percent of all privately held land (about 52 percent of all land in Thailand) is covered by full title deeds, and about 20 percent by permanent possession rights. These rights are not universally accepted as loan collateral for medium and long-term loans by commercial banks, and have limited legal standing. Furthermore, about 16 percent of privately held land is either undocumented or covered by certificates that are not transferable (except by inheritance) and thus are not shown on official cadastral records. Finally, at least 10 percent of Thailand's total area is in illegal settlements or is classified as forest reserves.

It can be concluded that adequate to abundant labor will be available for agricultural output expansion, that economic resources will be a limiting but not severely constraining factor, and that unavailability of land for further expansion will lead to the need for greater intensification of production methods. This means institutional resources will have to be more efficiently utilized to provide missing links in the entire package necessary for effective production. Without such support services for technology and input transfer, future per unit output improvements are not likely to take place on a sustained basis, especially in the rainfed areas of the Northeast. As the 1982 World Bank report (Vol. I, p. 11) states "the extensive transfer of yield-improving technology is hampered by (a) uncoordinated support services which fail to provide well integrated input packages; and (b) the lack of agricultural research and development efforts which are pointed at typical rainfed farming conditions, i.e., relatively high weather risks, low fertility soils, and limited availability of cash and family labor."

PART II. LIVESTOCK SUB-SECTOR OF THAILAND

Livestock Production

Cattle, swamp buffalo, poultry, and swine are the main farm animals found in Thailand. Chickens predominate in all general small farm production systems but there are some ducks, a few geese (interest is growing) and turkeys. The production system for chickens is dualistic with strong commercial broiler and egg laying flocks on the one hand, and a primitive backyard system on the other. Commercial poultry production outside the Bangkok area is still limited in both number of producers and scale of production.

The large commercial units are highly integrated, modern and highly efficient industries. They are similar to the vertically integrated system which is found in the United States and elsewhere. The producing units are usually tied closely with the formula feed companies which have promotional privileges and can provide integrated services to their client farmers including housing, health, feeds, management information, markets for the finished product and credit. The system is highly capital and labor intensive. In fact, the Thai poultry systems are so sophisticated and efficient that they compete with the United States for the Japanese market.

The backyard poultry industry is as primitive as any found in the world. The breeds of chickens are predominately the domesticated jungle fowl which are found all over Southeast Asia. Feeds consist of table scraps, some broken rice and whatever the chickens can obtain as they act as scavengers over the village--insects, feed particles in bovine manure, rice grains, etc.

Swine production also appears to be dualistic. However, the progress toward dominance by large-scale commercial units has been slower than in the case of poultry as it is estimated that 80 percent or more of the pork in Thailand is still produced by smallholders.

The slaughter age traditionally has been about 11-12 months with the carcass being quite fat, which formerly was in high demand for Thai cooking. However, at the present time, pork fat is not in demand and the price now is less than 50 percent that of lean pork meat. When scientists at the Universities and RTG livestock stations demonstrated that the western breeds of swine (Large White, Landrace, Duroc Jersey and others) were genetically superior to the native pigs for many economic parameters, a few commercially-oriented entrepreneurs quickly began upgrading programs for the native pigs using imported boars of the above breeds. These commercial units are now essentially vertically integrated in both the commercial production units as well as in the breeding units.

An interesting purebred operation is one in which the large purebred owner contracts farmers to produce purebred gilts. In general, a farmer will have a herd of 40 sows producing about two litters of purebred pigs per year. The large breeder guarantees to purchase all of the gilts while the males usually go into the trade. It is reported that there is one extension agent for each 30-40 farmer producers connected to a large contractor who is providing services on health, feeding, husbandry and marketing. This, like poultry, is a very efficient industry which is highly capital intensive. There is a growing tendency toward larger swine production units, putting more economic pressure on traditional smallholder units. This type of operation is described in detail in Part IV. Inventory data for 1965-1979 are given in Table 2.1.

Buffalo and cattle production systems are described in Part IV. There are relatively minor difference from other areas of Thailand so no attempt is made to describe the systems here.

Table 2.1. Buffalo, cattle and swine inventory in Thailand
1965-1979

Year	Buffalo	Cattle	Swine
	(Million head)		
1965	5.3	3.9	3.7
1966	5.4	4.0	4.0
1967	5.5	4.2	4.2
1968	5.5	4.3	4.5
1969	5.6	4.5	4.8
1970	5.7	4.7	5.1
1971	5.6	4.5	3.9
1972	5.4	4.5	4.0
1973	5.5	4.1	4.5
1974	5.6	4.1	3.8
1975	5.6	4.1	3.5
1976	5.9	4.3	3.4
1977	5.8	4.3	3.3
1978	6.0	4.4	5.3
1979	6.0	4.3	3.4

Source: Agricultural Statistics of Thailand. Office of Agricultural
Economics, MOAC, Bangkok, 1980.

The Feed Industry

The present feed industry is an integrated part of a modern, sophisticated, efficient, and highly competitive private sector enterprise. The initial developments began in the late 1960's, apparently as an integral part of the rapid expansion of the commercial broiler, egg, and pig production enterprises. These developments began in the areas surrounding Bangkok and have now spread to other parts of the country.

The export of feedstuffs has expanded during the 1970's (Table 2.2) reaching a value of over 1.5 billion Baht (\$65 million) in 1980. Corn and cassava have been the largest contributors to the export trade in feed ingredients.

In 1980, there were a total of 80 feed mills in operation in Thailand. Thirty-five mills are modern installations which are capable of producing about two million tons per year, while the remaining smaller mills can produce about 500,000 tons annually. The larger mills produce about 80 percent of the formulated feeds with most of this accounted for by the 8 largest mills. Competition in the feed sector is intense and is increasing as the industry matures. In 1965, there was a production of about 65,000 tons of commercial feeds. This increased to 110,000 tons in 1970, and then to 490,000 tons in 1975. By 1979, the production rose to 1.2 million tons and the industry is still growing. A small amount of the formulated feed is exported (about 1 to 3 percent) but this is expected to grow in the future. It is estimated that the feed mills operate at an average of about 60 percent of capacity.

The larger mills have many economic advantages over the smaller ones such as:

1. Many have promotional privileges;
2. All have cheaper bulk purchases of feed ingredients;

3. All have sophisticated storage and handling facilities for feed ingredients;
4. All have sophisticated computers for computing least cost rations on a continuing basis;
5. Nearly all can provide integrated service (vertical integration) to their customers--housing, health, feeds, extension, marketing of the finished product and credit;
6. All can provide better sales promotion and cheaper transport.

The small mills usually use Thai copies of American or European mills while the larger mills use imported engineering designs. In the case of the Charoen Pokphand Group, there is an engineering consulting group hired to build their new mills.

Table 2.2. Export of feedstuffs from 1971 to 1980

Year	Quantity (1,000 kg)	Value (1,000 Baht)
1971	57,315	94,916
1972	56,187	125,479
1973	111,923	300,126
1974	69,579	229,364
1975	77,192	232,790
1976	104,461	366,590
1977	145,259	700,725
1978	186,119	904,095
1979	271,543	1,387,825
1980	266,005	1,592,636

Source: Office of Agricultural Economics

Feed sources consist of fish meal, wheat bran, coconut cake, peanut cake, sorghum cake, other bean cake, cottonseed cake, kapok seed cake, palmtree and kernal cake, oil cake and residues, beet pulp, bagasse tregs and waste, vegetable products, forage, and other animal feeds.

The supply of local feeds exceeds the demand, thus the surplus is exported (Table 2.2). The important energy feeds are corn, broken rice, rice bran, sorghum, and cassava chips. The protein ingredients include fish meal, animal slaughter byproducts, poultry slaughter byproducts, sorghum, peanut, cotton seed, kapok, lencaena leaves, cassava leaves, and mungbeans.

Sorghum meal or cake is imported. Some minerals are available in Thailand; however, trace minerals and vitamin supplements are all imported. Corn is now the cheaper energy supplement, but this could change as the overseas market for cassava chips tightens.

The large mills produce, in addition to complete formulated feeds for chickens and swine, a protein-mineral-vitamin supplement which the farmer can mix with local energy feeds to provide a complete ration. The producers provide excellent instructions, and good results are obtained when these supplements are mixed with corn, rice bran, and broken rice. If demand develops, these mills can easily produce protein-mineral supplements to feed bovine animals receiving low-quality forages.

Antibiotics and other feed additives are monitored by the RTG through two agencies, the Food and Drug Administration (FDA) in the Ministry of Public Health, and the Division of Feed Quality Control in the DOLD. The FDA is concerned about effects on humans, while DOLD concentrates on effects on animals. In the event of delinquency or non-compliance, both of these agencies are empowered with legal authority for enforcement of regulations. In addition, a private group of citizens called the Consumer Protection Association monitors the industry and has been known to apply pressure on offenders.

Live Animal Marketing

Virtually all livestock and poultry are marketed privately. Apart from a half dozen holding yards in the North, there are no central markets for livestock. Cattle and buffalo are purchased from farmers by local traders. Animals to be slaughtered in nearby municipalities are usually sold to retailers who have the animals butchered and then sell the meat through their retail outlets.

The marketing of cattle and buffalo is more complicated when they are destined for Bangkok. In this case, the local trader resells the animal to a regional or national trader who has a license for interprovince shipment. That person either sells the animals to a person specializing in draft animals for use in the Central Plains, or a wholesaler at one of the Bangkok slaughterhouses. Wholesalers then resell the animals to carcass wholesalers (called butchers) who have the animals slaughtered and then sells and delivers the fresh meat to retailers.

Swine marketing is similar to cattle and buffalo except that large scale producers will sell directly to the wholesalers. Despite their size, even large-scale swine producers have little market power due to the iron hold of wholesalers.

Village level poultry producers will usually sell directly to a trader who then sells them to retailers who, in turn, have them processed. Some small producers take their own poultry to town where they may wholesale or retail them. Commercial egg producers sell their eggs directly to city wholesalers who distribute them to retailers. Commercial broiler producers ship their birds either to city wholesale markets, or to public or private slaughterhouses.

Processing and Slaughter

There are municipal abattoirs in all provinces. These facilities, which are operated through the Ministry of Interior, are generally old facilities with just a slaughter floor, roof and water facilities. They have low hygienic standards and lack adequate meat inspection.

It appears that the butchers, i.e. the person who purchases live animals and has them slaughtered, are relatively few in number and have at least moderate oligopolistic market power. All provinces also have numerous unregistered slaughter facilities.

Livestock slaughter in the greater Bangkok area changed greatly in 1955 when the Livestock Trading Corporation was established and given monopoly rights. They then took over the management of the two existing municipal slaughterhouses and, in 1961, a modern well-equipped facility was added. The Corporation made substantial profits until 1968 when irregularities led to a change in trading regulations. Throughout the 1970's their activities have been confined to slaughtering. Today, there are five municipal abattoirs in the greater Bangkok area, three of which are used for cattle, buffalo and swine, and two for poultry. Only one of the plants for bovines and swine has modern facilities and it is under utilized. In all facilities, the butchering and hygienic standards are very low with little difference between them and illegal operations (World Bank, June 3, 1982 (Vol. IV, p. 133)).

There are four modern private facilities for poultry slaughter. These operations, which have been developed by vertically integrated poultry producers since 1973, are of modern design, and operate quite efficiently. Their products are sold both domestically and exported. These processing plants accept birds from independent producers as well as their own contract growers. Because these plants control a substantial percentage of broiler processing, the market power of wholesale dealers in the city wholesale

markets and public sector abattoirs is much less than it is for cattle, buffalo and swine.

The major constraints to improved live animal slaughter and processing are of a structural nature, with the greatest difficulty being in (a) Government's unwillingness to promote private slaughterhouses and (b) control of slaughterhouses by the Ministry of Interior rather than the Department of Livestock Development (DOLD), a situation which precludes improved conduct and performance because there is no way to regulate trading practices and control health measures. Because of the unsatisfactory policy, unregistered slaughter in the Bangkok area, as well as the country as a whole, remains unabated. All types of livestock are involved in these backyard or specialty designed buildings which, because they are illegal, have no inspection of facilities or carcasses. It is estimated that between 50 and 70 percent of all slaughtering is illegal.

Overall, it appears that the greatest constraint to improved livestock marketing is at the slaughter plant level, and that this constraint can only be overcome by government making changes. If the oligopolistic power of meat wholesalers were removed, or at least severely restricted, there would be substantial improvement in live animal marketing with resultant reduced marketing costs.

It seems that the live-animal trade is relatively competitive even through high profits are reported by wholesalers at the slaughter plant level, and retailers. It is still not generally known, for example, that as of October, 1980, meat price controls were removed with the result that manipulation can and does take place of retail prices.* Also, it is not generally known that as of August, 1980, the restriction was lifted that carcasses and meat could not be transported across provinces.

*On June 27, 1979 a ministerial regulation (No. 27/1979) was passed by the Ministry of Commerce to control the wholesale and retail price of meat (in Bangkok only). On October 1, 1980, this law was rescinded (No. 36/1980) but, meat markets (in Bangkok only) are required to post the price they charge for meat.

Livestock Prices and Meat Consumption

Average wholesale prices of livestock and livestock products, given in Table 2.3, show considerable differences in terms of changes for the various commodities from 1960-1981. The price of beef carcasses has increased 608 percent and buffalo carcasses 493 percent, while pork carcasses have only gone up 274 percent. Chicken prices have increased just 79 percent and eggs 144 percent. Some specialists feel that the differences are due to eroding buffalo and beef populations but, probably more important is the amount of technological change that has taken place in each commodity's production and processing. This is reinforced by comparison with other countries where similar price changes have taken place. The greatest technological advances have taken place in poultry and secondly in swine.

It is estimated that as of the late 1970's about 15.7 kg. of fish and 10.0 kg. of pork were consumed per capita. In contrast, only 4.9 kg. of poultry were consumed and 4.0 kg. of cattle and buffalo. These estimates are based on Government's assumptions that about 50 percent of all slaughterings were unregistered. Regardless of the figure's accuracy, they do show sharp differences that are due to consumer eating habits, cultural customs, and relative price differences. In all likelihood, poultry consumption will continue to expand dramatically because of its price advantages and ease of handling.

Livestock products in Thailand have a high income elasticity of demand, which means that relatively small increases in income bring about relatively large increases in consumption. Given that the whole economy is expected to continue its rapid growth in the 1980's, the domestic market will provide a strong demand for livestock products. Pork and poultry consumption will probably grow fastest because of probable continued large improvements in all aspects of production and marketing. Bovine meat prices will likely increase the most as significant technological change is unlikely in the production and marketing of this commodity.

Table 2.3. Average wholesale prices of livestock and livestock products, Bangkok, 1960-1980

Year	Live buffalo (head)	Live Cattle (head)	Live hog (kg)	Buffalo carcass (kg)	Beef carcass (kg)	Pork Carcass (kg)	Duck (head)	Chicken (kg)	Capon (kg)	Geese (head)	Duck eggs (100)	Salted duck eggs (100)	Hen eggs (100)
----- Baht -----													
1960	1,175.00	1,125.00	6.30	5.50	5.50	7.34	9.95	11.42	14.18	12.60	50.00	65.88	52.88
1961	1,199.60	1,150.69	6.66	6.10	6.53	8.12	11.44	9.58	16.66	12.46	46.45	52.31	52.50
1962	1,145.42	1,189.20	6.33	6.75	7.25	8.82	9.55	9.64	17.35	12.50	57.77	65.72	-
1963	1,126.95	1,183.55	6.04	6.75	7.19	8.64	9.77	10.91	17.94	13.09	52.69	65.20	56.23
1964	1,142.00	-	7.28	6.69	7.27	8.95	9.40	10.94	14.58	23.78	40.85	51.28	45.98
1965	1,266.28	1,105.44	8.08	6.75	7.45	9.72	11.95	11.10	13.82	27.99	40.10	45.17	45.42
1966	1,381.67	1,259.41	7.07	7.09	8.08	8.38	10.08	11.04	13.31	24.39	54.16	61.00	55.78
1967	1,667.52	1,432.13	7.99	7.72	9.07	9.99	12.57	11.86	14.33	32.10	56.99	68.70	53.32
1968	1,701.10	1,500.95	9.61	7.81	9.30	11.17	11.04	14.09	15.12	36.87	52.28	64.16	45.97
1969	1,784.45	1,717.67	9.73	7.99	9.59	11.62	9.89	12.38	12.68	31.48	50.00	60.20	45.14
1970	2,504.10	-	7.58	8.20	10.00	9.32	9.85	12.75	13.49	35.83	46.15	56.32	45.11
1971	2,464.19	-	7.53	8.20	10.00	9.06	8.79	11.56	12.61	30.20	42.29	53.82	43.10
1972	2,039.40	2,014.32	9.78	8.78	10.06	10.72	8.38	12.31	13.85	30.45	45.15	51.17	47.29
1973	2,742.30	2,362.36	10.63	10.03	11.71	11.52	12.06	13.00	15.38	38.79	68.54	79.29	62.51
1974	4,217.40	3,748.36	17.11	15.43	17.52	19.51	19.90	15.98	19.53	57.31	103.73	119.79	89.11
1975	4,351.05	4,453.68	15.37	18.01	22.72	18.15	20.97	16.19	20.45	58.83	92.00	114.84	79.99
1976	4,306.50	4,262.72	15.54	17.57	23.77	17.69	17.10	16.44	20.51	56.60	94.20	127.57	96.66
1977	4,410.45	4,090.24	18.58	16.75	20.96	20.50	16.15	18.70	21.76	73.06	97.48	128.85	91.05
1978	4,539.15	4,077.92	14.25	16.89	19.96	17.50	18.43	18.33	21.85	63.20	111.17	140.46	102.57
1979	4,979.70	4,795.56	18.68	18.67	21.54	21.41	20.47	20.24	25.99	85.82	121.05	151.68	115.14
1980	5,940.00	5,500.88	21.97	20.49	23.73	25.24	20.91	25.00	26.38	94.67	133.42	165.49	123.81
1981	7,325.00	6,616.00	22.61	32.63	38.94	27.45	24.91	20.45	23.91	110.00	138.00	161.63	128.83

Source: Office of Agricultural Economics, Ministry of Agriculture and Cooperatives.

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Livestock and Meat Exports

Cattle and buffalo have traditionally been exported to Hong Kong and Singapore, primarily by ship from the disease free zone of Southern Thailand. They reached their peak in the late 1960's and have declined ever since, dropping down to less than 1,000 head in 1981 (Table 2.4). The export quota permits 51,800 head of cattle and 18,000 head of buffalo to be exported annually. Live pigs, primarily suckling pigs, have been exported for a long time to Hong Kong with great annual variations depending on the amount of competition from the Peoples of Republic of China. A joint venture commercial pig farm has been established in Southern Thailand for export to Singapore.

Frozen chicken meat has recently begun to be exported in considerable quantity, primarily to Japan. Exports from the three main firms reached 4,270 tons in 1977, 13,500 tons in 1979, 16,800 tons in 1980. The extent to which this expansion will continue is questionable since Japan is investing heavily in poultry operations.

Considerable debate has taken place about the export market potential for beef from Thailand, assuming a satisfactory method could be developed for producing it. An analysis of export markets (Simpson and Farris, 1982) indicates that only a very limited potential exists due to strong competition from the United States for high quality beef, and from a host of countries such as Australia, New Zealand, Argentina and Uruguay for lower quality product. Occasional selected opportunities will exist in Hong Kong, Kuala Lumpur, Singapore, and some Middle Eastern countries, but it is unlikely that sufficient volume can be developed to cover export promotion costs as the other countries are much more efficient in their production and have lower marketing costs.

Table 2.4. Thailand's exports of cattle and buffalo
1967 - 1982

Year	Number		Percent of Agri. export value (percent)
	Cattle (1,000 head)	Buffalo	
1960	0.3	100.1	-
1961	0.1	68.9	-
1962	0.0	61.6	-
1963	2.8	40.9	-
1964	16.6	50.4	-
1965	9.8	48.4	-
1966	9.0	46.5	-
1967	10.6	39.1	0.8
1968	8.0	23.3	0.6
1969	9.2	25.8	0.6
1970	9.0	26.0	0.7
1971	11.8	24.8	0.7
1972	18.2	25.2	0.7
1973	25.7	20.5	0.6
1974	17.9	11.2	0.3
1975	10.9	11.8	0.4
1976	12.8	16.1	0.3
1977	24.5	17.4	0.4
1978	27.7	22.8	-
1979	24.7	18.4	-
1980	8.5	5.0	-
1981	-	0.1	-

Source: Office of Agricultural Economics, Agricultural Statistics of Thailand (various issues) MOAC, Bangkok.

National Livestock Development

The RTG has set a target of 4.2 percent annual growth in livestock related GDP during the Fifth Five Year Plan (FY 82-86). This is compared with 5.4 percent annually during 1975-80. Specifically, they project cattle and buffalo GDP to grow at 1.8 percent, pigs at 2.2 percent, poultry at 4.6 percent and eggs at 7.4 percent. A recent World Bank mission (Vol. 4, June 3, 1982) was more optimistic, projecting an overall growth rate of 5.0 percent annually, and 2.5, 4.9, 5.0, and 7.4 percent for the above commodities. They state (pp. 149) "bovine production growth (2.5% p.a.) will be substantially below that achieved in the latter half of the 1970s (3.7% p.a.) with the feed base and long-term nature of improved breeding constituting the primary constraints." They also believe that while poultry production will grow at a relatively slow rate due to saturation of foreign markets, with recently passed liberalization of slaughterhouse regulations to permit private sector slaughter and processing, that pork and pork products export will grow rapidly.

Government's livestock development policy is based on (a) expansion of efficient commercial production and (b) programs in support of poverty alleviation programs. The effort is aimed at expansion and improvement of traditional livestock production on small holdings. It is recognized that, since bovines cannot be produced on large commercial units as there is basically no land available for ranching development, strategies will have to concentrate on the small holder. Because the production level opportunities are limited, beef prices can be expected to remain strong and thus provide an opportunity for increased use of more costly technology in bovine husbandry by small size farmers. The 1982 World Bank Report (Vol. IV, pp. 144) states:

"Smallholder cattle and buffalo development will still need to depend on public sector support. The institutional structure as well as the arrangements for farm level support need strengthening..... Hence, a minimum inputs package approach combining the distribution of upgraded animals (loan-bull program), vaccine distribution, and extension support to improve feed forage availability will have a significant impact on the smallholder if organized and implemented properly. DLD (DOLD) should be responsible for package formulation and evaluation and the training of subject matter specialists".

PART III. NORTHEAST FARMS, FARMERS AND SOCIAL ASPECTS

Introduction

Thailand is a typical developing and agricultural country in which a great majority of its population live in rural areas. Among the 4 major regions in the country, the Northeastern region is the poorest and most populous. The region is well known for its having the highest rate of fertility, mortality and out-migration. This makes it the most strategic region in terms of national social, economic and demographic development.

Northeast Thailand has an area of about 170,240 square kilometers, or 33 percent of the national area. The Mekong River on the North and East, the Phanom Dongrak escarpment on the South, and the Phetchabun ridge on the West. The area has an average density of 92.8 persons per square kilometer. The lowest density is found in the mountainous northwestern part of the region, Changwat Loei, where it is about 38.6 persons per square kilometer (Figure 3.2). The highest density is in the central part of the region, on the Mun - Chee river basin. (Table 3.1).

Within the 16 provinces (Changwats) of the Northeast, there are a total of 193 districts (Amphoes), 3 sub-districts (King-Amphoes), 1,981 counties (Tambons) and 20,828 villages (Mubans) (NESDB, 1980). The average village in the region is comprised of 710 people and 105 families, most of whom live in a nuclear family.

Figure 3.2. Population density by province in the Northeast region of Thailand, 1982.

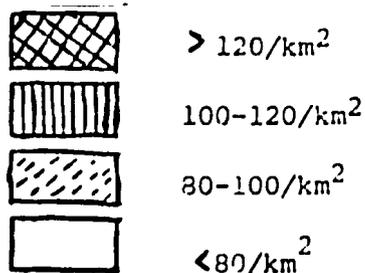
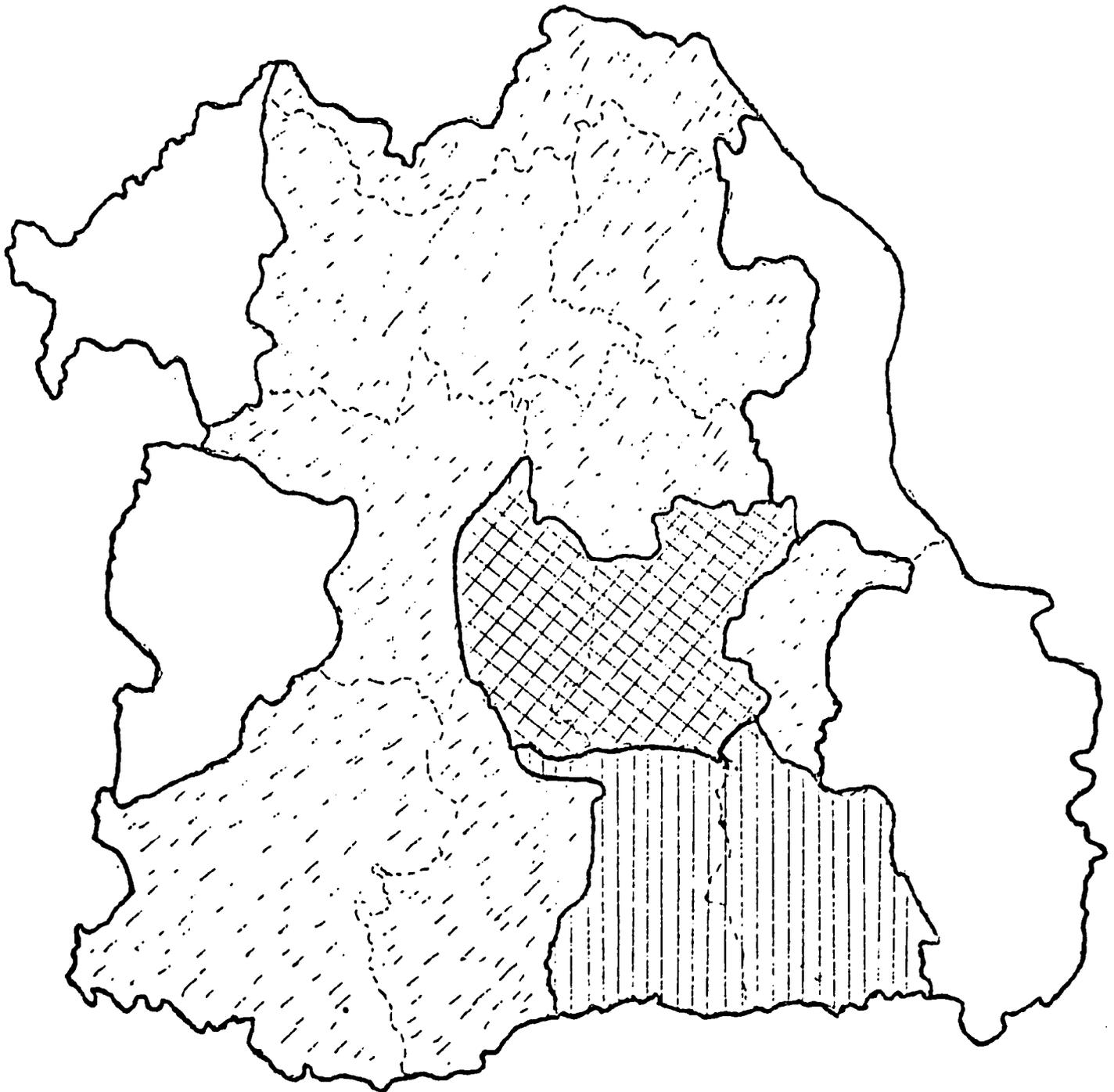


Table 3.1. Northeast Thailand population, percent of the municipal population, and population density, by provinces, 1979.

Northeast Provinces	Population	Share of Municipal Population (%)	Population Density (per square km)
Northeast region	15,792,825	4.3	92.8
Kalasin	741,969	2.9	106.8
Khon Kaen	1,328,835	7.6	122.1
Chaiyaphum	839,384	2.4	65.7
Nakhon Phanom	745,390	3.8	75.7
Nakhon Ratchasima	1,886,192	5.9	92.0
Buri Ram	1,107,818	2.2	107.3
Maha Sarakham	751,657	4.3	142.0
Yasothon	451,901	4.1	108.6
Roi Et	1,044,411	2.9	125.8
Loei	441,127	3.3	38.6
Si Sa Ket	1,066,287	1.8	120.6
Sakon Nakhon	765,620	3.2	79.7
Surin	1,001,075	3.3	123.2
Nong Khai	661,090	3.7	90.2
Udon Thani	1,429,128	5.6	91.7
Ubon Ratchathani	1,530,941	6.0	81.1

Source: Ministry of Interior, Population Registration Data, 1979

Population

Approximately 85 percent of the population live in rural areas where agriculture provides the major source of income and constitutes about 75 percent of employment (Bank of Thailand, 1979). In 1971, when the population of Thailand was 36.2 million, the Northeast ranked second to the Central region in terms of percentage share of the country's population. But by 1972 rapid population growth in the Northeast had brought the region to 33.9 percent of the total population, while the Central region had 32.5 percent. The percentage share of the Northeast increased to 34.3 percent in 1980 (Table 3.2). However, it is estimated that the percentage share will be reduced by the end of the Fifth Five Year Plan due to the Northeastern region's high rate of out-migration. (Prasith-Rathsint, et. al., 1981).

Population Growth Rate

Among the country's four regions, significant differences in demographic trends have emerged with regional rates of natural increase diverging substantially from the fairly uniform rate of 3.3 percent per year in the mid 1960's. The crude birth rate has apparently not fallen over the past decade, and the rate of natural increase is high. The structure of the population is beginning to differ among the regions, with the dependency ratio remaining constant or rising in areas such as the Northeast, and falling sharply in the North (Table 3.3).

The population growth rate as of 1982 in Thailand was reported by the Institute of Population Studies to be 1.8 percent annually. In contrast, the rate of growth in the Northeast is 1.7 percent. Much of this decline has probably been due to a variety of social and cultural conditions that seem highly conducive to the adoption of birth control methods.

Table 3.2. Percentage distribution of population by region
1971-1980

Region	C a l e n d a r Y e a r				
	1971 (%)	1972 (%)	1973 (%)	1974 (%)	1975 (%)
North	21.71	21.15	21.17	21.22	20.83
Northeast	32.55	33.87	34.26	34.29	34.28
Central	33.17	32.51	32.23	32.17	32.86
South	<u>12.57</u>	<u>12.47</u>	<u>12.34</u>	<u>12.32</u>	<u>12.53</u>
Total	100.00	100.00	100.00	100.00	100.00
No. of Population (1,000)	36,193	38,359	39,950	41,334	42,570

Region	C a l e n d a r Y e a r				
	1976 (%)	1977 (%)	1978 (%)	1979 (%)	1980 (%)
North	20.81	20.78	20.68	20.59	20.42
Northeast	34.23	34.27	34.27	34.25	34.26
Central	32.30	32.67	32.70	23.76	32.92
South	<u>12.33</u>	<u>12.34</u>	<u>12.35</u>	<u>12.39</u>	<u>12.40</u>
Total	100.00	100.00	100.00	100.00	100.00
No. of population (1,000)	43,214	44,282	45,222	46,134	46,961

Source: Department of Local Government, Statistical Yearbook(s), Bangkok.
Ministry of Interior, 1972-1981.

Table 3.3. Crude birth rate by region, 1972-1980

Year	Region				Total
	Central	North	Northeast	South	
1972	2.92	2.59	3.47	3.73	3.10
1973	2.67	2.43	3.37	3.17	2.92
1974	2.70	2.40	3.18	3.25	2.87
1975	2.57	2.18	2.96	2.97	2.67
1976	2.62	2.21	2.97	2.98	2.70
1977	2.30	2.02	2.78	2.57	2.44
1978	2.26	1.91	2.55	2.37	2.30
1979	2.24	1.95	2.58	2.53	2.33
1980	2.14	1.89	2.54	2.54	2.29

Source: Health Statistics Division, Ministry of Public Health,
"Birth Statistics", (Mimeograph)

The Poverty Problem

Poverty in Northeastern Thailand has been defined in a number of different ways. For instance, the World Bank has defined it with reference to the total household income from all sources with a particular figure being taken as the threshold of poverty. Government officials often equate poverty with remoteness of a segment of a populace from centers of services and marketing. There is something to be said for this definition: those who cannot avail themselves of access of markets, to secondary schools, to adequate public health services, to electricity, and so on do live lives that are deprived when compared with people who do have access to these services or markets, no matter what other characteristics they may have. Another cause of poverty that is commonly pointed to in the Northeast is inadequate water for both productive and consumption purposes. Those who live in rainfed areas, outside of irrigation districts, and particularly those who are continually subject either to excessive flooding or drought are again deprived relative to those who have assured access to water. Regardless how the problem is defined, the Northeast is a poverty area.

Analysis of the poverty problem over time shows that the incidence of poverty in rural areas has declined substantially since the early 1960's from 61 percent in 1962/63 to 35 percent in 1975/76. (Table 3.4). Three reasons have been given for this decline: (1) the increase in total cultivated area; (2) the increase in agricultural prices accompanied by the ability of some of the previously poor groups to switch into more profitable crops; and (3) increasing reliance on off-farm income opportunities.

Table 3.4. Incidence of absolute poverty*
By region and location, 1968-76

	Poverty as percent of population			% of poverty group
	1962/63	1968/69	1975/76	1975/76
	(%)	(%)	(%)	(%)
<u>Kingdom</u>	<u>57</u>	<u>39</u>	<u>31</u>	<u>100</u>
Urban	38	16	14	10
Rural	61	43	35	90
<u>Northeast</u>	<u>74</u>	<u>65</u>	<u>44</u>	<u>50</u>
Urban	44	24	20	1
Rural	77	67	45	49
<u>North</u>	<u>65</u>	<u>36</u>	<u>36</u>	<u>23</u>
Urban	56	19	18	1
Rural	66	37	34	22
<u>Center</u>	<u>40</u>	<u>16</u>	<u>14</u>	<u>9</u>
Urban	40	14	12	1
Rural	40	16	15	8
<u>South</u>	<u>44</u>	<u>38</u>	<u>31</u>	<u>12</u>
Urban	35	24	22	1
Rural	46	40	33	11
<u>Bangkok</u>	<u>28</u>	<u>11</u>	<u>12</u>	<u>6</u>

*The absolute poverty line is defined as \$100/year/person in rural areas and \$150/year/person in urban areas (1975/76 prices).

Source: "Income, Consumption and Poverty in Thailand", World Bank Staff Working Paper No. 364, November 1979.

General View of Villages in the Northeast

The typical Northeastern village is clustered with home sites and fields surrounding them. Some villages have houses scattered along the road while other are in blocks. Houses are built of modified Thai design, 1.50-2.50 meters above ground, and have one room or more, a kitchen and a large open area. The size of the house and homesite depend on the economic status of the owners. Some have well-defined homesites enclosed with a fence and planted with fruit trees. Most houses of lower income families are built of bamboo leaves, using dried grass for the walls and roofs. The better off villagers can afford houses which are built of wood and concrete block. Livestock are tied under the house. Most homes will have a bed under the house for added comfort.

Only some households have vegetable gardens. There is no public market in the village, except a small store where household necessities and food are sold. Most of the villagers go to town or district centers for their supplies. The social centers in the village are the local temple, school, and village hall. Some small villages have no local temple or school, having to share with other larger villages.

Agriculture is the most important sector (91.0 percent) in the Northeast in terms of occupation (Table 3.5). Non-agricultural labor is in services, commerce, and manufacturing activities; 3.7, 2.3 and 1.4 percent, respectively.

Glutinous rice cultivation occupies most of the northeastern farmland, with only a small amount used for non-glutinous rice production. Almost half of the farmers now grow cash crops such as, cassava, corn, tomatoes, sugarcane, peanuts and tobacco. They are also involved in livestock raising, silk-worm raising and silk weaving.

Many villagers still make many of their own utensils out of bamboo and rattan, weave some of their own clothes, and produce their own charcoal. Throughout the region, there are some villagers who are also able to supplement family income by producing such craft items as silk, rattan mats, and other utensils such as pots. There are also a growing number of villagers who are skilled mechanics, radio repair persons, carpenters, etc., although few such villagers make their primary income from the exercise of these skills. A major source of supplementary income for many farm families--perhaps most in the lower Northeast--are the jobs found in Bangkok and other places outside the region by villagers who become temporary migrants.

Table 3.5. Distribution of Northeast and whole Kingdom occupation in 1970

Occupation	Whole Kingdom (%)	Northeast (%)
Agriculture	77.8	91.0
Mining	0.5	0.05
Manufacturing	4.3	1.4
Construction	1.2	0.3
Electricity	0.2	0.04
Commerce	5.6	2.3
Transportation	1.8	0.8
Services	7.7	3.7
Others	<u>0.0</u>	<u>0.4</u>
Total	100.0	100.0

Source: Population and Housing Census, 1970.

Sub-Regions and Farmer Profiles

The Northeast has been divided into three sub-regions; Upper-Northeast, Mid-Northeast and Lower-Northeast.

The Upper Northeast consists of Udon Thani, Nong Khai, Sakon Nakhon and Nakhon Phanom.

The Mid-Northeast consists of Nakhon Ratchasima, Chaiyaphum, Khon Kaen, Kalasin, Maha Sarakham and Roi Et.

The Lower Northeast consists of Buri Ram, Surin, Si Sa Ket, and Ubon Ratchathani.

In the Upper Northeast, a typical farm household is a nuclear family in which four of the six household members will be engaged in agricultural work. Most holdings are about 25 rai with the main occupation growing glutinous rice for the family's own consumption. In the rainy season lower paddies are flooded and planted first. Cultivation of paddies further up the slopes proceeds steadily as the rainy season continues, with the upper banded fields often not being cultivated because of inadequate rainfall.

The Northeastern farmer keeps some chickens for the family's consumption and sale and has one or two buffalo which are used primarily for farm work, such as ploughing. Planting and harvesting rice uses family and exchange labor. Hardly any cash inputs are used, production techniques remain unchanged with the farmer using animal rather than mechanical power (except on irrigated land which is only 5 percent of the Northeast's arable land area), and the household continues to rely on family and exchange labor.

In the slack agricultural season there is an increase in non-agricultural activities such as house building, wood chopping, road construction,

charcoal making, fishing, etc., all of which are important sources of cash income. The Upper-Northeast has the largest porportion of farmers growing nothing but rice, although in the Northeast as a whole about half the farm households are in a similar situation. They also have an absence of adequate services, and the long distances to main markets are the major reasons for their being unable to break out of what is basically subsistence environment, at least in terms of their farming operations.

In the Mid-Northeast, over half of the farmers now grow an upland cash crop such as cassava. However, the typical farmer still plants enough rice for the household's own consumption and, indeed, will continue to forego other employment and income opportunities in order to plant and harvest this rice crop. They make a net income which is about 45 percent higher than the corresponding income of a typical farmer in the Upper-Northeast mostly due to additional earnings from upland crops. Some of this is from non-farm employment. Contractors frequently carry out tractor ploughing of the upland areas. Credit from merchants and other middlemen, as well as from banks is frequently used.

In the Lower-Northeast, where much of the population is of Cambodian origin, households have been subject to much the same forces that have determined agricultural development in the rest of the region. To a large extent they have been able to diversify into upland crops (kenaf) and produce rice surpluses and market livestock. Most of the roads were built for military purposes, but they have also assisted upland crop development.

In addition to farming, other occupations bring in small amounts of income. These include gathering plants, boiling and drying salt, gathering wood, making charcoal, raising silk worms, fishing, making leaf torches, catching frogs, making lime from the ashes of snails and shellfish shells, etc. Normally, the household is involved in only one or two of these occupations. The Lower-Northeast has a long tradition of seasonal migration, and at least one member of the household is likely to be away in the off-season, most probably in Bangkok.

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Land Utilization

Apart from small amounts of land used as people's residences, temples, schools, and roads, most of the village's land is used for agriculture. Typically, the low lying land will be used for glutinous rice farming, mainly for family consumption. If there is some surplus it will be kept for the next year or sold. The upper land will be used for crops such as cassava, kenaf, maize, sugarcane, peanuts, and tobacco. These crops are the most important sources of cash income for villagers.

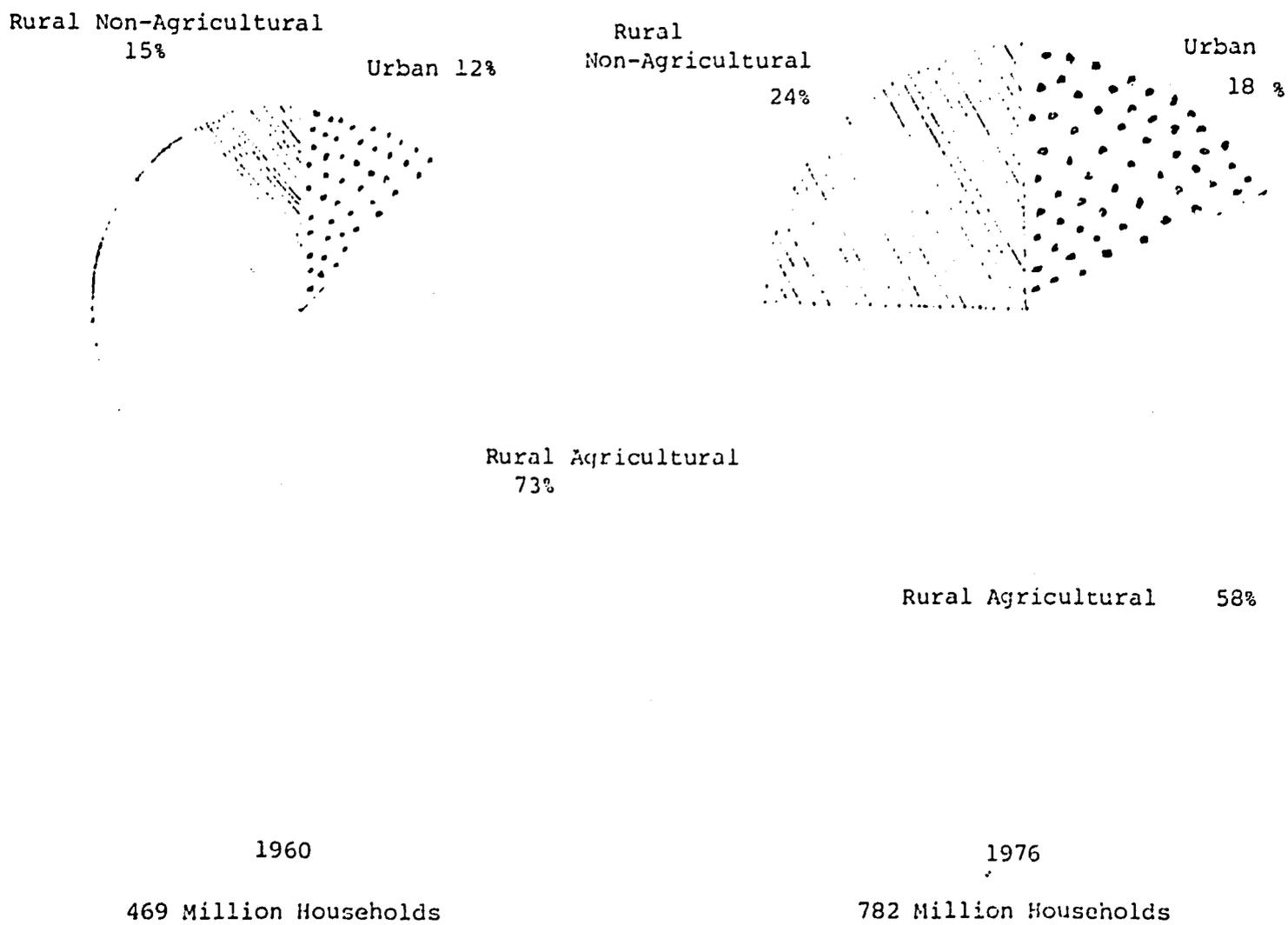
Rural-Urban Distribution

Since 1960, urban population has been growing at nearly 5 percent annually. The proportion of the country's population in urban areas increased from 12 percent in 1960 to 18 percent in 1976. Despite the apparently large percentage increase, because of its small absolute size, the rapid growth of urban population has had little impact on the size of rural population, and the majority of people in Thailand continue to live and work in rural areas.

The Thai population can be drawn as three large groups (Figure 3.3). The urban household, the smallest group, was 12 percent and 18 percent of the total in 1960 and 1976, respectively. The largest group, rural agricultural, was more than half of all households, 75 percent in 1960 and 58 percent in 1976.

The Northeast still remains overwhelmingly rural particularly when compared with the country as a whole. In 1976, 95.7 percent of the population of the Northeast resided in rural areas, and the agricultural households of the region accounted for 40 percent of all agricultural households in kingdom (World Bank, 1980).

Figure 3.3. Distribution of households
1960 and 1976



Sub-groups

Most of the Northerners speak the Northeast dialect and consider themselves to be culturally distinct from the rest of the country. The majority of the population belong to the Phaw-Thai (Thai-Isan) who migrated from Laos and the left bank of the Mekong River over the past few hundred years (KKU-Ford Cropping Systems Project, 1980). The Thai-Isan point to a variety of cultural practices which separates them from the rest of Thailand. They have, for instance, a distinctive language, a diet based on glutinous or sticky rice, minced meat, green papaya salad, and fermented fish. Their musical tradition includes use of the polyphonic mouth organ called the Khaen, and a type of singing as molam (Keyes and Thandee, 1980).

The Northeastern area is made up of five distinct sub-groups, the largest being the Lao-Wiang who live in the center and the Northeast of the region. The second largest group are the Thai Korat who constitute at least half of the population of Nakhon Ratchasima province. Furthermore, the region has nearly half a million Khmers in the southern part of the region, and 85-100,000 recent Vietnamese migrants who have settled in the towns or large villages. Lastly, there are Chinese merchants and Indian businessmen who are in most of the towns and large villages.

Mizuno (1968) in describing the inheritance pattern among northerners, stated that as a rule sons do not inherit farm land. Instead, they get betrothal money and one or two buffalo or cattle. Sons marry out and daughters remain at home after marriage. The young men usually acquire land by marrying or by opening up forest area. The youngest daughter and her husband are expected to stay in the parents' home and look after them until they die. In turn, they then inherit the house and paddy land. However, if the amount of farm land available is large enough other sons may inherit shares as well.

The family system of the Northeast traditionally emphasizes both matrilocality and matrilineality. With this pattern, women become the predominant force in the control of property in all activities. The division of labor between sexes is relatively minimal since either sex can do any job if necessary. Thai women have been regarded as hard workers because they work both in the family and outside. Apart from housework and farm work, they also feed and look after livestock. Within the household, women participate in making all important economic decisions and often actually control the cash available to a family. However, most important decisions are shared by both husband and wife, and men tend to dominate outside the family. In summary, the role is at least equally important, and possibly more importance, than that of men, as women tend to monopolize marketing of fruits and vegetables produced on the family farm, and of fish that are caught by the men.

Migration

The out migration rate from the Northeast is much higher than the immigration rates. Piampiti (1979), for example, mentioned that during 1950-1970 the Northeast had a net loss of about 111,000 people most of whom are young and economically active. Thus, their destination, Bangkok and other big cities, have gained this economically active population at almost no cost of human investment. Besides, Northerners can initially be hired at a relatively low wage rate. The large amount of out-migration from the Northeast will be an important demographic issue facing Thailand over the next decade. It is likely that the more predominant pattern of intra-rural migration, especially in settling new areas, may be offset by rapid increase in rural-urban migration especially in seasonal and other forms of back-and-forth movement to regional cities. Such movements should increasingly involve Northeastern Thais (Goldstein, 1977).

Education

Almost every adult person in the rural Northeast has completed primary school (4 years), but less than ten percent have studied beyond the first four years. Usually the register head of household (the husband) has a slightly higher education than his wife. In 1977, a law on education was passed that requires at least 6 years of study. Informal discussions with villagers indicates that considerably more emphasis is being placed on advanced education today than just a few years ago.

From data of National Statistical Office (1981) it is indicated that the Northeast regional population in 1981 was 16,993,400 and the school age population (age 4-24) for the Northeast was 8,350,800. The percentage of school age population to the whole population was 40.9 percent for the Northeast in 1981 compared with 40.7 percent for the whole Kingdom. However, while most villages have their own primary school, other villages have to share one with nearby villages. There are 1,053 secondary schools, mostly in the province or district centers. The institutes of higher education are shown in Table 3.6.

Table 3.6. Institutes of higher education in the Northeast

Institutes	Degree offered	Number
1. University	Bachelor and higher	2
2. Teacher Training College	B.S. and higher teaching certificate	6
3. Teacher Training College	Higher teaching certificate	2
4. Physical Education College	Higher vocational certificate	3
5. College of Technology and Vocational Education	Secondary education certificate & higher vocational certificate	4
6. Vocational College	Higher vocational certificate	17
7. Agricultural College	High vocational certificate	8

Source: KRU/FORD Cropping System Project, 1981. "An Agroecosystem Analysis of Northeast of Thailand", KRU, Khon Kaen.

Income

Besides, growing rice for family consumption farmers in the Northeast clear some forest or use some other land to grow upland cash crops if it is available. Income from the new upland cash crops, usually kenaf and cassava, has raised the income of the typical farmer about one-third to a half. But, nonetheless, per capita income in 1977 in Northeast was only \$112 as compared to the national average of \$226. In addition, some villagers living near rivers and other bodies of water catch fish to sell and trade. There is also a surprising amount of wild plants, insects, snails, frogs, gekha, etc. collected to use as food or trade.

Buffalo and cattle serve as a savings bank for farmers. Therefore, the number of cattle and buffalo can be viewed as an indicator of farmer capability to cope with their socio-economic setting.

Health and Nutrition

The health status of Northerners can be evaluated by studying death rates in comparison to other regions. The Report of Health Statistics (1975) shows a higher death rate in the Northeast than other regions prior to 1973, but since then its rate has been the same as other regions.

Health in the Northeast is served by two major hospitals; Nakhon Ratchasima and Khon Kaen. Each province also has a hospital and at the sub-district level there are public health stations. Most villages, however, are only served by volunteer medical-care villagers, and by Medical Service Mobile Units. They also get some medicine from drug stores.

Malnutrition among Thais continues to be a health problem arising from low levels of income, lack of nutritional education, high birth rates, certain taboos, and customs resulting in their food habits (Kieatviboon, 1981). The degree of malnutrition varies from place to place but, overall, most affected groups are the people in the rural area. In rural Northeast, the main source of protein and other vitamins is from vegetables and other non-animal protein sources such as fresh, fermented, and dried fish.

Mass Communication

Northeasterners lack continuing access to relevant printed media. To a considerable extent, information that might be channeled through publications reaches villagers through the medium of radio. Even the poorest households have one. Now that electricity has reached many rural communities, television is also beginning to find a rural audience, but only to a very small group who can afford a set. A lot of information flows in, out, and within the villages by word of mouth, being transmitted by officials, traders, and people who have worked outside the villages.

Target Beneficiary

The typical target client is a rainfed agriculture farmer who owns 25 rai (4.0 ha.) of land of which about 20 rai will be in paddy land. There will be about 6-7 family members including one or two grandparents. They will have one rai on which the home and a garden is located. Farmers on areas with upland will also have some cassava and/or kenaf.

Beneficiaries are located throughout the Northeast. The majority of family heads will have at least four years of schooling in the Thai educational system. Average household income is about \$800-900, about half of which is from rice while the rest is mainly from handicrafts, off-farm wages and cash crops. Family planning is now practiced by over 40 percent of the households. The vast majority of villages do not have electricity, but over 90 percent of the households have a radio.

Most households are within 3 or 4 kilometers of an all-weather (at least gravel) road. Formal organizations exist within the villages (temple, school, development committees, farmer's organizations, and cooperatives). Over 40 percent of the household head's belong to at least one of these formal groups. Many households have also participated at one time or another in "development" efforts, often under the "tambon council" fund program in building village roads, repairing bridges, etc.

The farming enterprise is risky both for crops and animals. Drought or less than satisfactory weather often reduce production, and disease causes widespread mortality in livestock. Because most farmers often have only one buffalo, and this is the exclusive source of draft power, loss of this animal can spell disaster for the family.

PART IV. THE NORTHEAST LIVESTOCK INDUSTRY

The purpose of this section is providing a comprehensive study and profile of the livestock industry in the Northeast. Because of the detail presented in Part II, macro level aspects are not discussed. Rather, a description of feedstuffs availability is first presented after which the focus turns directly to describing the various production systems. This section is then finalized by providing a summary of constraints which affect a potential livestock development project. Four village case studies are presented as Appendices 4.1, 4.2, and 4.3.

Commercial Feedstuffs Availability

There appears to be an adequate variety supply of commercial feedstuffs in the Northeast as there are many feedstores selling feeds, and mineral vitamin supplements which farmers can purchase and mix with local feed sources such as corn, cassava, rice bran, cracked rice, etc., to make complete rations. These feedstores also sell various vaccines and drugs for animal health. The number of these outlets is indicative that a third production phase based on a cash economy is growing in villages and areas in close proximity to urban centers.

Production Systems--An Overall View

It would be inaccurate to depict husbandry practices and performance as being uniform across the whole Northeast, or as being uniform even within a village. The variability of both terrain and monsoonal rainfall, as well as management practices dictate considerable place-to-place and year-to-year variation. Another factor is that village farmers vary considerably in their knowledge about husbandry methods, labor availability, and access to feedstuffs and improved inputs.

Farmers in the Northeast of Thailand, who are generally smallholders, have traditionally integrated their livestock and crop production, as in other parts of the country. Buffalo and cattle provide the main source of draft power for paddy rice production under prevailing rainfed conditions. Swine and poultry are raised to utilize rice by-products, such as rice bran and broken rice, as well as other home wastes, crop wastes, and weeds such as banana stems, sweet potato vines and tubers, papaya leaves, water hyacinth, etc. Pigs are generally sold for cash at six-month intervals, while chickens provide for current cash needs. Buffalo and cattle, on the other hand, provide a long-term saving for special occasions; for instance, wedding ceremonies, a son entering monkhood, or severe drought or flood. Livestock contributes between 25 and 30 percent of household agricultural gross income. This, however, does not include the values for draft, manure, or social value.

Poultry Production

The 1982 inventory shows there are about 16.5 million chickens in the Northeast (Table 4.1). Therefore, in one year, the total number raised would be at least 50 million chickens in the region (taking an average of 4 hatchings per hen per year). These chickens are generally produced from a backyard system in villages. About 80-90 percent of households raise some indigenous chickens, ranging from 5 up to 50 birds per household. The 1978 census indicates that approximately 77 percent of the total holdings had 1 to 19 chickens, while another 23 percent of the total holdings had 20 to 99 chickens. Therefore, it can be said that practically all (99.61%) chicken production in the Northeast in 1978 was in the hands of the smallholders. Since the census was carried out, commercial poultry production of both broilers and layers has slowly developed in the Northeast but, even today, the number of large producers and their scale of production is still quite limited.

Table 4.1 Livestock inventory in the Northeast by province,
May, 1982

Province	Hogs	Chicken	Duck	Cattle	Buffalo
(Number)					
Yasothaon	59,215	582,386	143,017	67,745	120,487
Korat	157,416	2,249,210	323,074	230,459	284,178
Chaiyaphum	58,211	590,752	123,395	107,963	151,320
Buri Ram	134,339	1,233,416	271,498	77,075	318,503
Surin	-	-	-	-	-
Si Sa Ket	94,320	1,057,455	331,890	91,720	225,721
Ubon	164,974	2,748,084	515,780	220,010	368,200
Kalasin	46,964	588,910	199,085	93,822	208,583
Udon	70,738	1,497,763	550,711	116,347	353,726
Nongkhai	15,070	388,583	127,074	30,453	159,899
Loei	23,335	211,424	135,817	33,967	67,111
Sakon Nakhon	53,049	1,462,480	257,590	187,310	175,427
Nakhon Phanom	-	-	-	-	-
Khon Kaen	74,692	1,253,089	427,065	154,129	289,202
Maha Sarakham	73,915	1,066,982	302,034	167,629	208,182
Roi Et	<u>146,167</u>	<u>1,568,387</u>	<u>790,571</u>	<u>114,520</u>	<u>237,757</u>
N.E. Total	1,172,405	16,498,921	4,498,591	1,693,149	3,168,296

Source: Agricultural Statistics of Thailand, Office of Agricultural Economics, MOAC, July 1982.

Chickens in the villages, almost all of which are of indigenous stock, are generally raised for both cash income and home meat consumption. Certain imported (exotic) breeds have been raised on an experimental basis by some villagers, but they have not been widely accepted because of a low survival rate, or poor production under village conditions. They have also been found to be more susceptible to predators and diseases than indigenous birds. The indigenous chickens are generally "Ooh" or "Tapao" strains, but some are "Chae". The first two strains are larger, while the latter is a small type raised mainly as a pet and is not so economically important.

Villagers permit their chickens roam freely all day looking for feed. These feeds generally consist of fallen paddy grains, worms and insects found in cattle or pig manure, table scraps, as well as local weeds and grasses. One of the popular feeding places for chickens is in the cattle or pig pen. Sometimes they may be fed small amounts of broken rice or rice bran, especially during routine rice pounding. Some villagers buy some broken rice from small rice millers.

Village chicken raising normally requires very little or no cash inputs for breeding stock, feeds, medical supplies, etc. Breeding stock are available from home hatching, while most feeds can be found around the household areas by chicken scavengers. Medical treatment or vaccination against diseases is rarely practiced by villagers. The most popular place for chicken housing is under the house or under the rice storage building, with a piece of bamboo rail as a roost during the night. Some villagers let their chickens roost on trees.

Mating between chickens takes place naturally and randomly because of both sexes and all ages being allowed to roam freely. Generally, the hens are bred by a flock rooster. The age at which a hen first begins laying is 190 to 250 days of age. Hens lay eggs in clutches with about 8-16 eggs per

clutch. After laying, the hen will brood for a period of 21 days. Then, after hatching, the chicks are reared by their mothers for about 40-60 days until they can look after themselves. The hen then will commence laying in another clutch, continuing in this sequence throughout the year. A nest is located in a relatively safe place from cats, dogs, snakes, or thieves, and is made from a wooden box or bamboo basket laid with paper or straw. Hens normally lay eggs in the morning or late morning. The ratio of roosters to hens in villages averages from 1:7 up to 1:18, with the more common ratio being 1:13.

Farmers raise chickens mainly for sale when needed, as well as for home meat consumption. Hence, breeding roasters and hens are normally maintained for chick production as villagers generally do not consume chicken eggs, but rather duck eggs. The main reason is to better keep chicken eggs for hatching, and raise the chicks for household meat rather than for egg consumption.

Survival rates of chicks without disease outbreak ranges from 72-87 percent. The survival rate in the rainy season is generally lower because of high humidity, strong wind, and fluctuating temperatures which make chicks susceptible to respiratory disorder and other infectious diseases. Outbreaks of Newcastle disease are more frequent in the rainy period than in other seasons. In contrast, outbreaks of fowl cholera, a disease that mainly affects mature birds, is most frequent in the summer (February - April).

At six months of age, the male chicken weighs from 1.5 to 2.0 kg. and the female 1.1 to 1.4 kg. At one year the ranges are 2.4 to 3.3, and 1.5 to 2.4 kg. for the male and the female, respectively (Table 4.1). Village chickens reach maturity at about 1-3 years of age at which time their weights range from 3.2 to 4.3 kg. and 2.1 to 3.2 kg. for the male and the female, respectively.

In general, village chickens are sold to local buyers who visit households on motorcycles equipped with a bamboo cage. Most chickens for sale are young, with an average weight of about 1 kg., or old culled roasters or hens. The main reason for selling is the need for cash rather than the culling of excessive stock.

Price determination is based primarily on chicken body weight. Once the price is agreed on by both parties, chickens will be weighed by the Chinese-type scale. The local buyers will sell these chickens to the Amphoe merchants, who in turn take them to provincial markets where they are then generally sold at a 25-50 percent higher price than regular commercial broilers produced locally or from the Bangkok area. The sale of chickens takes place any time of the year, but most sales occur from January through March, especially during February on the Chinese New Year Festival. At this time, village chickens are in their prime condition due to abundant feed supply as this is just after the rice harvest season.

Village chicken production faces two major problems, (1) high mortality due to infectious diseases such as Newcastle disease, fowl cholera, fowl pox, infectious bronchitis, etc., and (2) low productivity. A 1980 study on 30 villages (Palara, et.al.) reveals that not over 6 percent of village chickens have ever been vaccinated against infectious diseases with vaccines obtained from a government agency. Also, most village chickens have never been vaccinated with vaccine from any source. As a consequence, it is estimated that about 50-70 percent of village chickens are lost each year due to infectious diseases.

Apart from the heavy losses due to infectious diseases, the productivity of village chickens, as compared to those in commercial production (Table 4.2), is relatively very low, although their adaptability to village conditions is quite favorable, especially their survival instinct, ability to search for feeds, broodiness, and rearing of chicks, etc. Their egg production is only 24 to 80 eggs per year as compared to 280-300 eggs per year from commercial layers. Their growth rate is also much slower than that of commercial broilers. Crossbreeding of village chickens can improve many of these characteristics, but the surviving ability of the crossbreds under village conditions is yet to be examined. It should also be noted that chicken feed availability under the existing system of village poultry production could be a limiting factor if village chicken productivity is to be drastically increased.

Table 4.2. Production coefficients for chickens in the Northeast of Thailand

Item	Unit	Traditional	Commercial
Age at which hen first begins laying	Days	190-250	165-180
Hen/rooster ratio	-	7-18	12-15
Replacement age of hens	Yr	3.5	1.5-2
Eggs per clutch	Eggs	8-16	-
Average clutches per year	-	3-5	-
Eggs per year	-	24-80	250-300
Survivability of chicks to 60 days of age (no disease)	%	72-87	95
Mortality of hens	%	10-15	2
Hatchability	%	58-94	80-95
Weight of chickens (60 days)	kg.	.030-.043	.035-.040
Weight at six months			
Male	kg.	1.5-2.0	-
Female	kg.	1.1-1.4	1.5-1.8 (crossbred)
Weight at marketing (56 days)			
Male	kg.	-	1.5-2.0
Female	kg	-	1.5-2.0
Weight at 1 year			
Male	kg.	2.4-3.3	-
Female	kg.	1.5-2.4	2.0-2.5
Weight at maturity			
Male	kg.	3.2-4.3	-
Female	kg.	2.1-3.2	2.5
Gain per day, 60-180 days			
Male	kg.	.012-.016	-
Female	kg.	.009-.011	-
Broiler, gain per day	kg.	-	.026-.036

Source: Village Level from Chantalakhana, 1981 and Palarak, et.al., 1979; Commercial Broilers from Mr. Anunong Cheochernviljit; Commercial layers from Animal Science Department, Kasetsart University.

Swine Production

The 1978 National Agricultural Census indicated that there were a total of 1.3 million pigs in the Northeast, approximately 22 to 25 percent of the total pig population in Thailand. About 26 percent of the total number of holdings in the Northeast raised some number of pigs. Among them, about 85 percent have 1 to 4 pigs, while another 14 percent have 5-19 pigs. It is clear then that at that time at least 90 percent of pig production in the Northeast was in the hands of smallholders.

Pig production in the Northeast can be classified into two general types: weaner pigs and fattening operations. These enterprises are almost exclusively operated by smallholders, especially those in villages and around suburban areas as there are only a very few larger commercial pig farms in the Northeast at present time. Commercial farms generally concentrate on fattening operations.

Pig production is traditionally associated with rice production, where rice bran and broken rice are sometimes used by small farmers as feed supplement for pigs. This is usually purchased from a village miller. Village pigs are generally fed with locally available weeds and crop wastes such as water hyacinth, morning glory, banana stems, grasses, sweet potato vines and tubers, papaya leaves or fruits, etc. They are fed only minimum amounts of rice bran or broken rice, and these are usually boiled or mixed with garbage. In some areas pigs are allowed to scavenge around the household, or cropping areas near the villages during the day, and then given supplemental feeds in the evening. Sows will be fed twice a day. Weaner pigs may be fed with pig starter ration when weaner pig price is good, but most farmers (60-70 percent) do not purchase any commercial feeds for either growing or breeding animals.

In general, the pigs raised by smallholders are mainly crossbreeds of Large White, Landrace, and Duroc Jersey. These crossbreeds originally resulted from crossbreeding between these exotic breeds with the Thai indigenous pigs, known as "Kwai" pig and "Raad" pig by the local people, about 20 years ago. Today, virtually all pigs throughout the Northeast are crossbreeds of some exotic breed with less than 5 percent having traces of indigenous strains. At the same time, very few farmers in villages raise purebred exotic pigs.

Average age of gilts at first breeding on village farms is 14 to 20 months (Table 4.3). When a gilt comes in heat the owner will hire a breeding boar from a boar operator available in the same village or in a nearby one. Mating takes place either at the gilt's or boar's pen, according to an agreement on service charge, with guarantee for conception. The average sow to boar ratio in villages is around 65 to 85, with the preference for Large White and Landrace boars. The charge for boar service is generally paid in cash, ranging from 50-150 Baht per conception. Many farmers, however, pay in kind such as three chickens, a certain amount of sugarcane, or one weaner pig.

The average village sow produces about two litters a year, with 9 to 12 live pigs at birth. About 7.5 pigs are weaned per litter at an age of 8 weeks. Death loss of pigs from birth to weaning is around 21 to 35 percent. Average weight of pigs at weaning (8 weeks) is approximately 8 to 12 kg. Most sows will be kept for 6 to 10 farrowings, or up to 5 to 6.5 years of age before disposal. Some sows that still produce well will be kept for a longer time. On average, village raised sows produce about 12 to 19 weaner pigs per year (Table 4.3).

Housing for pigs is usually made of locally available materials such as bamboo and nipa-palm or tree-leaf for roofing. Generally, no cash inputs are required for housing construction, except those for medium-scale

production where cheap construction materials are sometimes required. Sows are usually tied by a cord from their neck to the tree or house post, and kept on a dirt floor. Only 15 to 30 percent of Northeast pig raisers have pens with cement floors and permanent roofing. Other facilities for pig raising such as feed troughs, water troughs, etc. are usually made of locally available materials. For example, feed troughs could be made of wood, split car tires, or old utensils.

Pigs in villages are often not vaccinated against the common infectious diseases such as foot-and-mouth disease, hog cholera, etc., and are usually not treated for parasitic diseases. Free government health care service is generally available from the District Livestock Offices, but remote villages usually are not reached.

Fattening of barrows or gilts in villages is considered by most farmers as a means of savings, while more market-type operations are usually concentrated around Changwat and Amphoe suburban areas, where fattening operations are usually related to rice milling or utilization of food-store and restaurant garbage. Barrows or gilts in villages are usually raised until they attain a body weight of 120-130 kg. with an average slaughter age of around 270 to 300 days. Pigs are raised to heavier market weight than in commercial operations because transportation and slaughter costs are charged on a per pig basis. These barrows and gilts yield dressed carcasses around 55 to 60 percent of slaughter weight.

The sale of pigs commonly takes place at the farmer's household. Buyers and farmers negotiate, with price set on a per head basis. Young pigs are frequently sold at about 10 days of age for roasted pigs in large city restaurants. Weaner pigs are sold at about 8 weeks of age with a weight of 8 to 12 kg. The price ranges from 120 to 500 Baht per pig, depending on market price of live pigs. Slaughter pigs, sold in the same manner, are collected from different villages and brought to a central roadside area.

They are then placed in individual rattan baskets and transported by truck to either city slaughterhouses or to central livestock markets. Culled sows and boars are also sold for city slaughter. Village slaughter of pigs is very rare, occurring only during certain traditional ceremonies.

Commercial-scale pig production in the Northeast is very limited, with only a few farms of 100-300 fatteners found around Khon Kaen, Korat, or other large cities in the Northeast. (For more details on commercial pig production coefficients see Table 4.3). Feeds are usually mixed on the farm using commercial premix sold in bags, with corn, rice bran, and broken rice. Vaccination against hog cholera is common on these farms. Because the largest pork market is in Bangkok, and because many large commercial pig farms with breeding and fattening operations have developed near Bangkok, such as those in Nakhon Phathom area, the Northeast is at a disadvantage due to the long distance and consequent high transportation charges. If pigs could be slaughtered in the Northeast and shipped in refrigerated trucks, this could be conducive to expansion of commercial pig production in the region. But, at present time, there is no modern slaughterhouse in the Northeast. Also, there is no limitation on pig fattening anywhere in Thailand as far as feed supply is concerned. Rather the major limiting factor is the demand for pork.

Table 4.3. Production coefficients for swine in Thailand

Item	Units	Traditional	Commercial
Farrowings per sow per year	No.	2.0	2.2
Pig per litter, live	No.	9-12	9-10
Pigs weaned per litter	No.	7.5 (8 weeks)	8.5 (4 weeks)
Death loss, birth to weaning	%	21-55	10
Average weight per pig at weaning	Kg.	8-12 (8 weeks)	6-8 (4 weeks)
Pigs weaned per sow per year	No.	12-19	18-19
No. of farrowings prior to sow disposal	No.	6-10	4-8
Age of gilt at first farrowing	Mo.	18-24	11.8-12.8
Age of sow at disposal	Yr.	5-6.5	2-2.5
Sow/boar ratio	Sow	65-85	20
Average weight of barrows and gilts at slaughter	Kg.	120-130	90-110
Average age at slaughter	Days	270-300	180
Net gain, weaning to slaughter weight	Kg.	110-120	82-104
Average daily post-weaning gain	Kg.	0.36-0.44	0.55-0.69
Average age at first breeding	Mo.	14-20	8-9
Dressing percent	%	55-60	60-65

Source: Village level estimates from various sources by Charan Chantalakhana; commercial from Mr. Anupong Chochernviljit (Swine producer in Nakhon Pathom).

Buffalo and Cattle Production

Almost 65 percent of Thailand's water buffalo are found in the Northeast, while more than 40 percent of cattle are produced in this region. The 1978 National Agricultural Census revealed that 3.6 million buffaloes and 1.7 million cattle are also found in the Northeast. About 74 percent of the total number of farm holdings raised some buffalo, while about 21 percent have at least one head of cattle. In many villages almost every household has some buffalo and/or cattle while in others only a few have cattle. Among buffalo holders, about 82 percent have 1 to 4 head, while only 18 percent have 5 to 19 head. Hence, it can be said that practically all buffalo are in the hands of smallholders. For cattle production, around 70 percent of farmers who own cattle have 1 to 4 head while about 28 percent have 5 to 19 head. Similar to other species it can also be concluded that over 90 percent of cattle owners are smallholders. However, it should be noted that a larger percentage (28 percent) of cattle raisers have relatively large numbers of animals (5-19 head) as compared to buffalo raisers (18 percent).

Land cultivation in Northeast villages depends almost entirely on buffalo power. More than 60 percent of all village buffalo, or virtually all mature animals of both sexes, are trained and utilized for draft purposes. Draft buffalo are used for tillage (of both paddy and kenaf) at about 60 to 120 days per year during which time they prepare an average of about 1.6 ha. per animal per year. Average years of work for buffalo is 12, after which the animals will be sold for slaughter.

Most rice production in the Northeast depends on the use of buffalo and cattle for land preparation, transportation, etc. The use of animals for draft is quite suitable economically and socially since most farmers live in remote areas and own only small parcels of land, while family labor is available whenever needed. Buffalo and cattle production is not regarded as a distinct enterprise; rather, it is an integral part of the crop production

system and many characteristics of these systems are reflected in the patterns of bovine use and production. In addition to providing the main source of draft power to crop farming in the Northeast, cattle and buffalo also represent long-term savings as well as security of farmers in case of crop failure.

Northeast farmers usually set aside small plots of land, 1 to 4 rai, for buffalo and cattle grazing to supplement other sources of grazing areas available in the village such as paddy fields, scrub forests on upland areas, highway shoulders, rice bunds, communal grazing lands, etc. In general, buffalo and cattle depend mainly on rice straw and stubble, while other crop residues such as corn stalks, cassava and kenaf leaves, etc., also provide substantial sources of roughage, especially during the dry season. Bovine breeding stock are generally produced in the individual's own herd with only infrequent purchases of breeding stock from outside sources. An exception would be efforts at improving their livestock's genetic base.

From December through February, i.e. the post-harvest season, all buffalo and cattle are allowed to graze in the paddy fields where breeding will also take place. During March through May (the dry season), feed in the paddy fields becomes so scarce that some farmers have to graze their buffalo and cattle in upland scrub forests or on highway shoulders, etc. At this time they supplement them with rice straw or other green fodder when animals return home in the evening.

From May to November, the cropping season when paddy fields are all under rice and the upland areas are under upland crops such as kenaf, sugarcane, groundnuts, corn, etc., animals will be grazed in fallow fields and the plots set aside for them. They are also occasionally tied around the household and fed with rice straw. Some farmers may cut-and-carry green grasses from upland crop areas or backyard fields for their buffalo and cattle. No concentrate or mineral supplements are given to them. There are

virtually no cash inputs used and most tending is done by family labor. Animals are generally kept under the house during the night where they are more safe from thieves.

Practically all village buffalo are the indigenous swamp type. They can be found in two colors, black or grey, and white. Only about 3 to 15 percent of them are white even though there is no scientific evidence so far to discriminate against them as far as production and work abilities are concerned. There do exist, however, some traditional beliefs against white buffalo as, for instance, some villagers believe that white buffalo meat produces an allergic reaction in pregnant women, some believe that white animals belong to some mythical spirit, and others contend that white buffalo are not as resistant to sunlight as grey ones, etc. In contradistinction, some villagers take white buffalo as good luck.

Buffalo breeding generally takes place through random natural mating with no color discrimination. Artificial insemination in buffalo has been offered by government only during the last 2 to 3 years, and then only in limited areas. Within-breed breeding is commonly practiced in buffalo, with limited interest for crossbreeding with Murrah buffalo (milk type). Only limited numbers of the first generation crossbreds can be found in the Northeast. Some farmers complain about the difficulty in handling crossbred buffalo at work, but this could be attributed to the training of them.

The average weaned buffalo calf crop for the Northeast as a whole is 35-40 percent per year and the average calving interval of cows with calves is one and a half years (Table 4.4). Pre-weaning death loss is estimated to be as high as 10-30 percent, but post-weaning death loss is usually low (2-3 percent). Age of buffalo cows at first calving ranges from 4.5 to 5.5 years, which indicates that their age at first breeding is around 3.5 to 4.5 years.

Buffalo calves at birth weigh around 24 to 32 kg. and at weaning (8 months) 90 to 120 kg. The post-weaning gain ranges between 0.24 to 0.30 kg. per day when they are fed mainly on grass. The weight of buffalo cows averages 350 to 440 kg, while mature castrated males average 500 to 550 kg. Mature animals dress out at 45 to 50 percent.

Most of the Northeast's 1.7 million cattle are still the Thai indigenous breed even though Brahman crossbreeds can be found in many areas due to introduction of Brahman bulls into villages by the Department of Livestock Development during the last 30 years. The Brahman crossbreeds adapt well under village conditions and are quite well accepted by the villagers. Some raise high grade or even purebred Brahmans. Brahman and crossbred cattle command a much higher price per kg. than that paid for buffalo or indigenous cattle. Production of crossbred calves is either through natural mating via the DOLD's bull loan program, by using privately owned bulls, or through the artificial insemination service offered by the DOLD. A.I. service, however, is generally limited to farmers who live near the A.I. stations or within 20 km. radius from the Livestock Development Centers (LDC's), there are only 80 LDCs. The demand for Brahman bulls by farmers continues to be high in the Northeast and throughout the country as a whole.

During the last 3 to 4 years farmers have become increasingly interested in crossing Brahman crossbred cows to Holstein-Friesians (with frozen semen) in order to produce crossbred dairy heifers to be sold at a government guaranteed price of 40 Baht per kg. (\$0.79 per lb.) for females and 20 Baht per kg. (\$0.40 per lb.) for males at auction markets in Ban Phai and Maha Sarakham.

In general, cattle in villages produce about a 40 to 45 percent calf crop per year, with a calving interval of one and a half years. Calf death loss from birth to weaning is 5 to 15 percent, while the estimate after weaning is as low as 2 to 3 percent. The average weaning weights of

indigenous cattle, Brahman halfbreds, and purebred Brahmans are 80-100, 100-150, and 130-180 kg., respectively. Under village conditions, cows commonly produce their first calf at 4.5 to 5 years of age. By the time they have been replaced at 15-16 years of age they will have produced only 5 or 6 calves. A comparison of Northeast coefficients with those under similar climatic conditions in Florida, U.S.A., is given in Table 4.5 to place the Northeast data in perspective.

Steers from the indigenous Thai breed, Brahman-cross, and Brahman breeds, commonly gain 0.20-0.24, 0.30-0.35, and 0.35-0.40 kg. per day, respectively, when fed on grass or natural grazing areas. However, if they are raised on improved pasture with reasonable supplement, these three breeds can gain 0.30-0.40, 0.35-0.60, and 0.80-1.00 kg. per day. The mature weights of indigenous and crossbred steers averages 375 to 425 kg., and 500 to 550 kg., respectively, with average dressing percentages of 45 to 55 percent.

About 30 percent of the total cattle herd are for working i.e. draft. Cattle bullocks are generally preferred for cartage because they move at a faster speed as compared to buffalo. Villagers generally select bigger animals, both cattle and buffalo, to be castrated for work, since the castrated animals will become tamer and easier to handle.

Health care for buffalo and cattle is very minimal. Some of them may be vaccinated against certain infectious diseases, but most are not. Farmers usually have little interest in bovine vaccination, except after a disease outbreak takes place. One common infectious diseases in bovine animals is foot-and-mouth disease of Types A, O, and Asia-1 while Hemorrhagic Septicemia is very serious in buffalo. Anthrax in both buffalo and cattle is common. A small percentage of village cows are found to be positive for brucellosis. In addition, internal parasites such as strongeloides and neoscaris are also commonly found in both buffalo and cattle. In general, farmers do not buy any medicine to treat sick animals, preferring to use

traditional curing methods practiced since ancestral times. Some herbs and medicinal plants are also available in villages, but there is some question about their effectiveness.

Farmers rarely sell their buffalo or cattle, except during exceptional occasions. When they do, sale of buffalo and cattle in the Northeast generally occurs at the farmer's household. The buyer and the farmer will bargain on the price which is determined by eye and experience as no weighing is conducted since animal scales are unavailable. The sale of buffalo and cattle generally takes place more often during July to October i.e. after rice planting. Some farmers may purchase a work animal or a breeding cow to replace some old stock if they have sufficient cash income from rice selling; this is considered to be a source of saving rather than using banks.

Table 4.4. Production coefficients for buffalo
in the Northeast of Thailand

I t e m	Units	Coefficient
Calf crop (weaned)	%/yr.	35-40
Calving interval	Yr.	1.5
Death loss (weaned calves & older)	%	2-3
Death loss (birth to weaning)	%	10-30
Replacement rate (cow herd)	%	6-7
Age of cow at replacement	Yr.	16-17
Land use per A.U.	Ha.	0.15-0.20
Animals per family	no.	1-4
Weight at birth	Kg.	24-32
Weight at weaning (8 mo.)	Kg.	90-120
Weight of cows	Kg.	350-440
Weight of bullocks at maturity	Kg.	500-550
Age at first calving	Yr.	4.5-5.5
Dressing percent (bullocks)	%	45-50
Post weaning daily gain, grassfed bulls	Kg.	0.24-0.30
Finishing phase daily gain, feedlot steers	Kg.	0.40-0.70*
Area of land plowed per day	Ha.	0.14-0.15
Days worked per year	Day	60-120
Area of land plowed per buffalo per year	Ha.	1.6
Average age of bullocks at slaughter	Yr.	15
Average years of work by buffalo	Yr.	12

Source: Chantalakhana, et.al., 1979a and 1979b.

*Same ration as cattle

Table 4.5. Production coefficients for beef cattle in the Northeast Thailand compared with Florida in the U.S.A.

I t e m	Units	Northeast	Florida, USA
Calf crop (weaned)	%/yr.	40-45	75-80
Calving interval	Yr.	1.5	1.0-1.2
Death loss (weaned calves & older)	%	2-3	2
Death loss (birth to weaning)	%	5-15	3
Replacement rate	%	6-7	11
Age of cow at replacement	Yr.	15-16	12
Land use per Animal Unit	Ha.	0.15-0.20	1.2-1.5
Animals per family	No	1-4	25-300
Weight at weaning (8 mo.)			
Native	Kg.	80-100	-
Crossbred, native/Brahman	Kg.	100-150	-
Brahman	Kg.	130-180	190-210
Weight of cow			
Native	Kg.	175-250	-
Crossbred, native/Brahman	Kg.	300-425	-
Brahman	Kg.	450-550	450-550
Age at first calving			
Native	Yr.	4.5-5.0	-
Crossbred, native/Brahman	Yr.	4.5-5.0	3-3.5
Brahman	Yr.	4.5-5.0	3-3.5
Weight of steers at maturity			
Native	Kg.	375-425*	-
Crossbred, native/Brahman	kg.	500-550	-
Brahman	kg.	-**	400-500

Source: Chantalakhana, et.al., 1979a and 1979b.

* Bulls castrated at 3 years of age

**Not usually castrated.

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Table 4.5 (cont.)

I t e m	Units	Northeast	Florida, USA
Dressing percent, steers or bulls (hot weight)			
Native	%	45-55	-
Crossbred, native/Brahman	%	50-55	-
Brahman	%	-	60-65
Post-weaning daily gain, grassfed steers			
Native	kg.	0.20-0.24	-
Crossbred, native/Brahman	kg.	0.30-0.35	-
Brahman	kg.	0.35-0.40	-
Finishing phase daily gain, feedlot steers			
Native	kg.	0.30-0.40***	-
Crossbred, native/Brahman	kg.	0.35-0.60***	-
Brahman	kg.	0.80-1.00***	1.10-1.20

Source: Chantalakhana, et.al, 1979 and Simpson, Baker and Eason, 1981.

***60-70% cassava chips, 10% corn, molosses and cottonseed meal.

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Summary, Constraints, Conclusions

The purpose of this section has primarily been to describe the livestock production systems found in the Northeast. The analysis indicates that all systems are rudimentary. Animals are raised in a manner which involves the least use of cash inputs, a practice which results in animal husbandry management which is usually well below the economic optimum, i.e. the point where marginal cost equals marginal revenue. The practices are perfectly rational from the villager's view point, one which prioritizes risk aversion. Thus, the human factor is probably the greatest constraint, with technical factors subservient to it. Our reason why Northeast farmers act as risk minimizers is the continually decreasing size of holdings as well as grazing lands for bovines becoming scarcer. Also, communal lands are constantly overgrazed to the point that land and forage programs are virtually impossible to instigate. Public lands are becoming less fertile as nutrients are leached out.

The constraints to animal production in the Northeast run from feeding to management, and health to government policies. Animals grow and thrive because they are hardy. In a word, animals survive because of their inherent abilities and not because of good or even moderate management practices, at least in an advanced husbandry sense. This is not to say that animals are not well taken care of--they are, but within the context of constraints imposed by village conditions on their owners. The net result is periodic large-scale losses due to disease, drought and economic conditions.

It is concluded that village chickens cannot compete with large scale egg and broiler producers even though there are specialized premium price local markets for native chickens. With the exception of improving animal health and providing information about improved management, little can be done to stimulate production. Thus, very little emphasis will be placed on poultry in the subprojects developed in Part VII.

Commercial swine production is equally as modern and efficient as in commercial poultry operations. Improved crossbred hogs are commonly found in villages and, even though their feeding and management may not equal that on large farms, they do utilize local agricultural by-products, and produce feeder pigs for larger farms. If they have sufficient feed, weaners are fed to market size. Swine production in Thailand easily meets domestic consumption needs. Without an export market, any great increase in production would result in economic loss to producers. Therefore, within this project there is little need for a swine project activity. Rather, just as with poultry, assistance to swine will be channeled through the animal health and management programs.

Beef and buffalo are a source of food and power as well as being a form of savings for farm families. About 77 percent of Northeast farmers own buffalo and about 25 percent own cattle. Well over half of these owners have less than 10 head. Farmers in rainfed areas of the Northeast could benefit from improved breeding stock; animal health services; better forage for animals (forage crops also fit into farming systems nicely complementing soil conservation efforts) and improved marketing. This project will primarily focus on these areas of assistance.

Analyzing the needs of Northeast farmers indicates they would benefit most from improving their calf production operations, and moving into producing dairy crosses for dairy farms around Bangkok. There is also considerable potential for them to grow-out calves for sale as breeding stock, and to fatten them to slaughter weights. Also, as commercial feed lots develop in areas of agricultural waste products, they can supply feeder cattle and buffalo calves or yearlings to these operations.

Reproductive efficiency in both cattle and buffalo is rather low with a calving interval of 1.5 years and high calf mortality (10-20 percent). Improved health care for the females would result in high conception rates from both AI and natural matings. These areas need to be concentrated on in only livestock improvement project. Detailed observation animal health are presented in Appendix 4.4

PART V. INSTITUTIONAL ANALYSIS

This section is comprised of 5 parts; the Department of Livestock Development (DOLD), other government agencies, external assistance, a summary of the Northeast Livestock Development Project, and constraints.

Department of Livestock Development

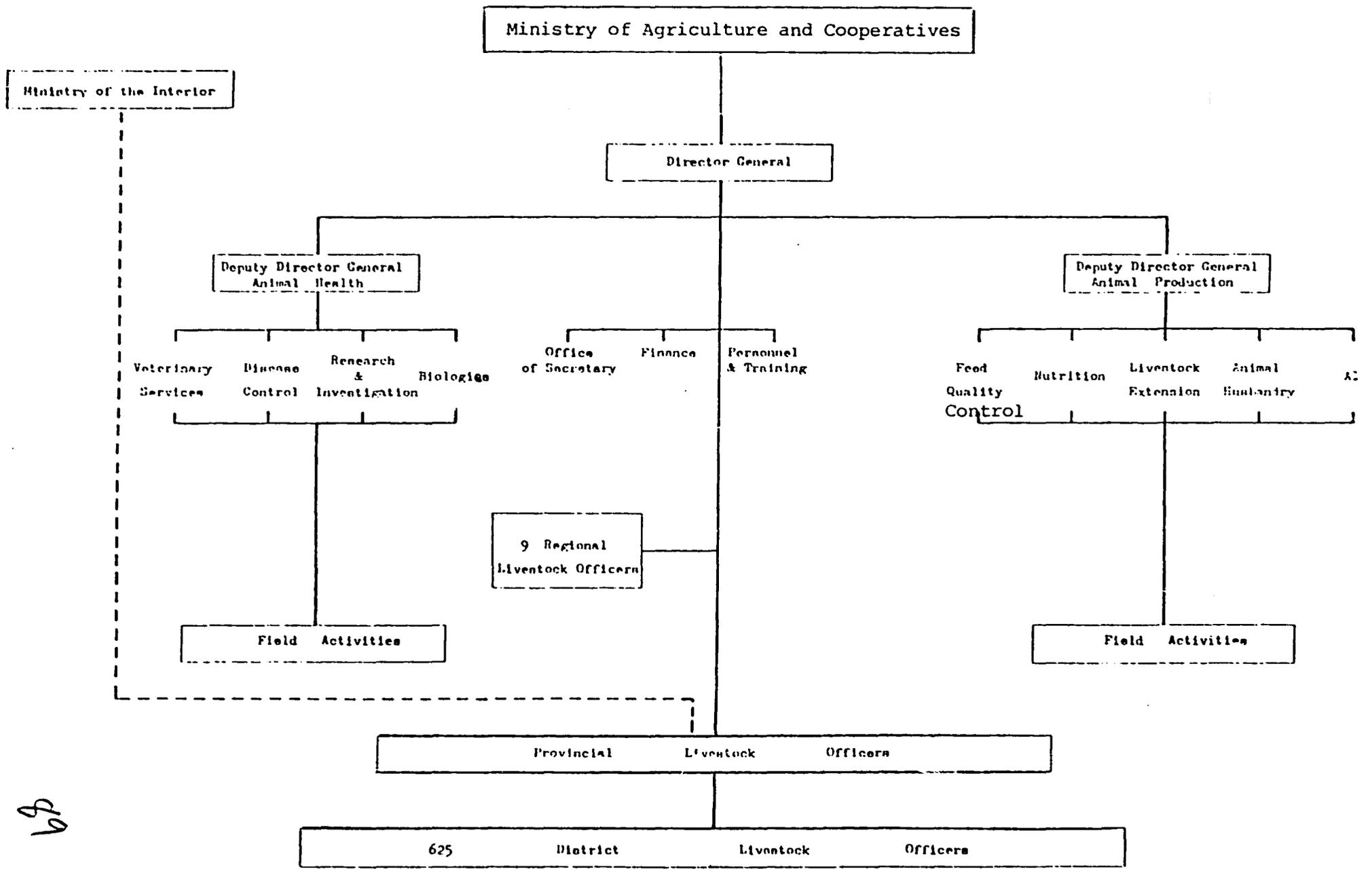
The Department of Livestock Development (DOLD) in the Ministry of Agriculture and Cooperatives has all-encompassing responsibilities on matters of animal agriculture. These are to:

- Control animal diseases;
- Initiate and coordinate programs in livestock improvement;
- Conduct research on animal breeding, nutrition and diseases;
- Produce vaccines, sera and antigens for both domestic and foreign use;
- Provide animal diagnostic services;
- Register and control veterinary practitioners and livestock traders; and
- Register producers of animal feeds and control feed quality.

These duties are designed to be carried out through an administrative structure approximating that shown in Figure 5.1.

The Director General (DG) is assisted by a secretariat and Divisions of Finance and Personnel. Four divisions relating to animal health are under one Deputy DG while five divisions related to animal production are under a second Deputy DG. Field work on some 40 stations throughout the country is directed by the technical divisions in Bangkok.

Figure 5.1. Organization of the Department of Livestock Development, as of August 1982



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There are 9 regional offices in the field, but these have only had an inspection and reporting function until now. However, they may be strengthened in the future to have a broader role in coordination and direction of Department services. Provincial and District Livestock Officers are responsible to both the DOLD and to their local administrators in the Ministry of Interior.

The recently terminated World Bank project (described later), based at Tha Phra, was administered as a separate agency which reported directly to the DG. Activities and personnel in the Livestock Development Project (LDP) are still functioning, pending reorganization by the DOLD.

Staff levels of the various DOLD divisions are shown in Table 5.1. In the just-completed fiscal year, there were 684 people involved in veterinary-related work and 1,025 people in animal production-related activities. Twenty percent of the funded positions were vacant. In addition to the total of 3,651 positions in the DOLD, a further 581 positions have been approved but are not yet funded. Also, in addition to the personnel listed in Table 5.1, the Department employs some 2,000 full-time laborers plus additional temporary workers on its numerous facilities.

Tables 5.2 and 5.3 provide further information on staffing of the DOLD. If the personnel numbers are stacked according to Civil Service Commission levels, they would form a sharply peaked and broadly based pyramid. Virtually all M.S. and Ph.D. trained personnel are sited in Bangkok, but many of them have responsibility for field activities.

One important point is that the data in Tables 5.2 and 5.3 are somewhat misleading for, while they show about two thirds of the personnel as located in the Central office, in reality at least half of them actually work most of their time outside of Bangkok.

Table 5.1. Staff levels within DOLD, FY 1982

Division of Authority	Personnel Numbers			
	Actual Staff	Vacancies	Total Funded Positions	
Administration	4	-	4	
Secretariat	33	3	36	
Finance	49	1	50	
Personnel	40	3	43	
Veterinary Service	114	20	134	
Veterinary Biologics	87	15	102	
Disease Control	351	128	479	
Veterinary Research	135	21	156	
Animal Husbandry	376	90	466	
Artificial Insemination	158	40	198	
Animal Nutrition + Pastures	183	45	228	
Feed Quality Control	25	-	25	
Livestock Extension	23	3	26	
NE Livestock Development Project	260	40	300	
Regional offices	25	3	28	
Provincial offices	<u>1,039</u>	<u>327</u>	<u>1,376</u>	
Totals	615	2,912	739	3,651

Source: DOLD Personnel Division

Table 5.2. DOLD personnel: hierarchy, location and entry levels

P.C. Level	Central	Regional	Total	Description
11	-	-	-	
10	1	-	1	Director General
9	2	-	2	Deputy Directors General
8	7	-	7	Division Heads
7	27	28	55	PLOs & Scientists
6	133	53	186	-
5	223	178	401	DVM
4	305	251	556	DVM, BS, MS, & Ph.D
3	450	233	683	Paravets, B.S.
2	788	592	1,380	Paravets
1	<u>315</u>	<u>65</u>	<u>380</u>	Clerks, typists
Total	2,251	1,400	3,651	

Source: DOLD Personnel Division

Table 5.3. Educational status by location of DOLD personnel

Degree Held	Central	Regional	Total
Ph.D.	4	-	4
M.S.	31	-	31
B.S.	138	400	538
Vocational	1,138	816	1,954
Other	<u>940</u>	<u>184</u>	<u>1,124</u>
Total	2,251	1,400	3,651

Source: DOLD Personnel Division

The DOLD has numerous in-house training programs for their personnel. The Training Division conducts study sessions year-round for entering and existing staff. There is also a curriculum to prepare village volunteers to assist field workers in disease control work, and a two-year curriculum to train paravets to work as assistants to District Livestock Officers. The latter program has a total of about 600 students at three teaching sites: Bangkok, Chiang Mai and Khon Kaen.

There are numerous DOLD personnel abroad in various short-term study tours and seminars although only 6 staffers are currently on leave for graduate studies abroad. Four of these are in veterinary-related studies and two are in animal science curricula. An additional two women staffers on educational leave will apparently not return to their posts; this is reportedly a fairly common hazard.

Table 5.4 presents data on the current DOLD budget. The following points can be made:

1. The funds directly budgeted for relief of welfare work are a small proportion of the total;
2. More is spent on veterinary research than on production-related research, but livestock development receives considerably more funds than does disease prevention; and
3. Cattle and buffalo receive far greater attention than do the other livestock species.

Appendix 5.1 contains a description of the major functions and physical facilities of the DOLD divisions engaged in Northeast activities.

Table 5.4. DOLD budget by activities or areas of work, FY 1983

Item	Budget		Percent
	(Baht)	(US\$)	
1. General Administration	<u>21,317,700</u>	926,826	03
Administration	17,365,300		
Feed Quality Control	3,475,200		
Animal Treatment Section	477,200		
2. Field Administration	<u>118,843,000</u>	5,167,087	19
Administration	100,110,400		
Livestock development in sensitive areas	5,000,000		
Drought relief in Tung Gula area of the Northeast	7,124,300		
Livestock development in the South	3,500,000		
NERAD counterpart fund	3,108,300		
3. Poverty Relief Work	<u>37,532,800</u>	1,631,861	06
Buffalo bank projects	24,000,000		
Small animal projects in villages	13,532,800		
4. Research	<u>29,321,900</u>	1,274,865	05
Veterinary research on animal health	20,709,900		
Animal science research	8,612,000		
5. Livestock Development	<u>268,426,700</u>	11,670,726	44
Cattle and Buffalo	233,426,700		
Swine	22,278,300		
Poultry	12,076,200		
Other species	927,000		
6. Disease prevention	<u>139,972,100</u>	6,085,744	23
Biologics production	43,830,800		
Disease prevention	<u>96,141,300</u>		
Total	515,595,700	26,781,117	100

Source: MOAC.

Other Public Institutions

The National Security Command (NSC) directs livestock extension activities similar to those of the DOLD, but only in several border areas that are politically sensitive and therefore dangerous for normal operations. At the Sakon Nakhon NSC unit, AI services produced 13,000 "confirmed" calves last year using semen of several European beef breeds as well as Brahman, Sindhi, and buffalo. Crossbred calves are purchased from farmers at above-market prices, grown-out on station land, slaughtered, and the meat shipped to Bangkok in refrigerated trucks and sold at a premium to restaurants. The number of animals marketed this way is still small--about 20 head per month. The program has obviously received strong and enduring support through the military arm of the RTG. Relations between the NSC and DOLD personnel appear to be amicable and perhaps complementary.

Another institution with possibly important effects on Northeast livestock is the Faculty of Agriculture at Khon Kaen University. This institution is thoroughly described in a separate RAI study and so will not be reviewed here.

A complete description of the functions and facilities of RTG institutions related to the northeastern livestock industry is given in Appendix 5.1. In addition, remarks are provided as explanation about their involvement.

External Assistance

The Ministry of Agriculture, in general, and the DOLD, have had a long history of cooperation with international donors, research and development agencies, and foreign governments on agricultural research and development projects. Some of these international cooperation programs are described in the following sections.

The World Bank has funded the largest program in Livestock Development in Thailand, one which ended in June, 1982. It had as its main objective the promotion of cattle and buffalo production in the Northeast. It is felt that the project was partially successful as it, with the help of scientists from New Zealand, established procedures for growing more forage on public land (highways and forests) and on communal grazing lands. However, over-grazing and abuse of these lands has minimized the project's impact. The project also established an organizational change in the DOLD by establishing the LDU's and LDC's which could form the basis for a strong future extension function in the DOLD. One accomplishment of the project was establishing techniques for pasture improvement on private farm lands and backyards of villagers. These accomplishments will likely grow and make a future impact upon bovine production in the Northeast. Detail about the livestock project is given later.

The World Bank has proposed a second (perhaps follow-up project) which would have, if approved by the Bank and the RTG, two major objectives:

1. To strengthen the DOLD to fulfill its responsibilities to the livestock sector in general, and to enable small holders to use the opportunities for developing commercial livestock production systems; and

2. to provide credit which would support commercial production by smallholders.

The initial project had a budget of \$14.6 million (U.S.), of which there was a World Bank loan of \$5 million, a contribution of \$0.6 by New Zealand, and a contribution of \$9.0 by the Royal Thai Government. The proposed follow-up project, which has not been approved, has a total budget of \$68.9 million (U.S.) of which \$11.7 million would be for strengthening the DOLD while the remainder would be used for credit to smallholders.

The UNDP/FAO also has under consideration, with good prospects for approval, a livestock component to their present Rainfed Crop Production Research and Development Project of Thailand. The objectives of the livestock segment are to:

1. Demonstrate improved means of storage, and use of surplus grains, beans, peanuts and other crops for small scale pig and poultry units.
2. Demonstrate the ammoniation of rice straw and maize straw under plastic to improve digestibility, by ruminants, of crude protein availability.
3. Utilize beans in feedstuffs, and to utilize rice hulls as poultry litter for subsequent feeding to ruminants.
4. Demonstrate the value of green Leucaena as a feed for ruminants and the drying of Leucaena meal and its use in poultry and swine rations.
5. Demonstrate the use of manure residues from fish ponds and bio-gas units as a soil conditioner.

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6. Demonstrate the use of dried cassava roots as a feed source.
7. Demonstrate the use of sundried and pulverised leaves of cassava as a source of protein for livestock.
8. Encourage feeding of beef animals where forage is deficient.
9. Demonstrate balanced rations using local ingredients and their values in feeding animals.

The project has a probable starting date of September 1982 with a proposed budget of \$743,468 (U.S.) for a three-year period.

The Asian Development Bank has proposed a project for consideration in which fattening units, mainly in the central plains area or the upland areas immediately surrounding the central plains, would be established. The project would, if approved, use agricultural by-products such as pineapple residues from canning operations and other sources of by-products as the base feeds in fattening cattle. If the plan were adopted, it would give some impetus to turning the Northeast and other areas into cow and calf operations. The proposed project would be conducted over a period of 5 years with a budget of about \$39.5 million (U.S.)

A key feature of the preliminary ADB proposal is creation of a Meat Industry Promotion Organization (MIPO). The functions of the MIPO are to:

1. Promote the domestic market for graded meat.
2. Promote meat export through better grading, sanitation, promotion, etc.
3. Provide technical support to the meat industry.

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4. Establish slaughter/meat packing facilities and to operate these until the private sector would take these over.
5. Establish feed mills and operate these until the private sector would take these over.

The Rockefeller Foundation has been active in institutional development programs in Thailand over the past 16 years. The major emphasis has been in Kasetsart University for the development of agricultural sciences in cooperation with the MOAC. The Foundation has also had long-standing research programs in corn, sorghum and rice (both the high-yielding short-stem varieties as well as the deep-water ones). At one point there was considerable emphasis upon the development of the Agricultural Experiment Station of Farm Suwan, which is now the National Corn and Sorghum Center. Since 1975 the Rockefeller Foundation has supported a program on the improvement of the swamp buffalo, as well as programs in both swine and beef cattle improvement.

The Ford Foundation has had active programs in institutional development in Thailand by supporting programs in the MOAC, and at Chiang Mai and Khon Kaen Universities. The major emphasis has been on multiple cropping, training, and integrated farming systems.

The IDRC has funded, in part, a cropping systems network in Thailand, and has aided the National Buffalo Research and Development program in the collection of the world's literature on buffalo and in publishing a monthly magazine called the Buffalo Bulletin.

The Federal Republic of Germany has put some input into strengthening the N.E. Regional Diagnostic Laboratory in Khon Kaen. Most of the inputs have gone for equipment, training and supplying short-term consultants and technical help. Because of their inability to recruit all of the needed consultants, the program has not made the expected rate of progress. The present contract ends in mid-year 1982 and a possible extension is under discussion. It is anticipated that the extension, if approved, will provide more technicians for operating equipment already in place, but idle because of lack of trained personnel.

The Government of Japan has aided projects for animal health improvement since 1977. The first project had its major thrust in the FMD vaccine production center at Nong Sarai and for improvement of the Southern Diagnostic Laboratory Center at Thung Song. The first phase of these projects ended in 1980. Phase II began in 1980 and ended in 1982 while Phase III is underway in a contract which will end in 1984. In Nong Sarai, the Japanese aided in constructing and equipping a new laboratory for Foot and Mouth Disease Vaccine. The Laboratory is in operation and is producing FMD vaccine type O, and FMD vaccine type A for swine and cattle (ASIA-1).

The Food and Agriculture Organization (FAO) established a Regional Dairy Development and Training Team For Asia and the Pacific in 1981. Headquarters of this activity is located in Chiang Mai; the project will end in 1984. Even though the project is regional in scope and short-term in nature, it is expected to make an impact on dairy production in the Northern Region.

Northeast Livestock Development Project (NELDP)

A rather complete description of the Northeast Livestock Development Project (NELDP), with headquarters at the Tha Phra Livestock Station near Khon Kaen, and administered by the DOLD, is provided at this point since the livestock project part of the RAI program is largely aimed at strengthening this institution, providing a new focus within its activities, improving coordination with other DOLD activities, and in assuring that it will be a focal point for the DOLD's Northeast activities in the future.

The project came into being in February, 1976, when the Royal Thai Government and the World Bank signed a 5 million dollar loan agreement. The RTG contributed 9 million dollars and an additional 0.6 million dollars was obtained from the New Zealand Government. The project's focus has been on an integrated livestock station and village level pasture and livestock program. A headquarters unit at Tha Phra was developed along with 16 livestock development units (LDU's) and 80 livestock development centers (LDC's). Some of these are located in conjunction with other government agencies or stations in the Northeast, while others are separate.

An organizational diagram, presented as Figure 5.2, shows that there are four divisions; administration, livestock research and demonstration, pasture research and demonstration, and livestock production. The project and its director are responsible directly to the Director General of DOLD, i.e. at present they are not part of any particular division in DOLD. As of February, 1982, there were 373 permanent positions approved with 257 persons actually employed. The number of subject matter specialists by degree held is given in Table 5.5.

Table 5.5. Training and area of specialization by subject matter specialists (SMS) in the Northeast Regional Livestock Development project, August, 1982

Item	Degree			
	Less than B.S.	B.S.	M.S.	Ph.D.
(number)				
Livestock Production and Research				
Breeding and Management	3	2	1	-
Physiology	2	2	1	-
Animal Nutrition	2	3	-	-
Artificial Insemination	2	2	-	-
Pasture Development				
Communal, Private, Backyard	2	1	-	-
Seed Production	2	3	-	-
Mobile Training Unit	2	1	-	-
Animal Health (vet.)	-	1	-	-
General Administration	6	2	-	-
Central Machinery Unit	4	-	-	-
Statistics and Evaluation	2	1	-	-
Chemical Analysis	-	3	-	-
Research and Livestock Development Station	4	-	-	-
Total	31	21	3*	0
Grand Total	- 55			

*Includes one studying for higher education.

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Activities within the broad objective of increasing productivity of livestock in Northeast Thailand, and thereby increasing village family farm income, have included:

Oversowing approximately 50,000 hectares of communal land and roadsides with pasture legumes;

Insemination of nearly 50,000 head of cattle;

Administering vaccine;

Sowing of more than 11,300 hectares of private pasture to legumes;

Distribution of more than 4,000 kg. of improved forage seed to more than 81,000 farmers for backyard forage production. This includes leucaena and forages for green chop;

Loan of nearly 700 Brahman bulls;

Nearly 400 tons of legume and grass seed produced by a farmer contract service.

Overall, the project has been aimed at cattle and buffalo.

One of the projects' more successful programs has been the growing of seed by villagers on a contract basis. It has been found that yields are higher than those obtained on stations and, more important, it has provided a good source of additional income to small farmers. One of the less successful projects is the loan bull (more accurately rent-a-bull) program, one in which stations' rent bulls to villagers for a selected period of time. The program has not proved very successful since villagers have not taken good care of bulls since they did not own them.

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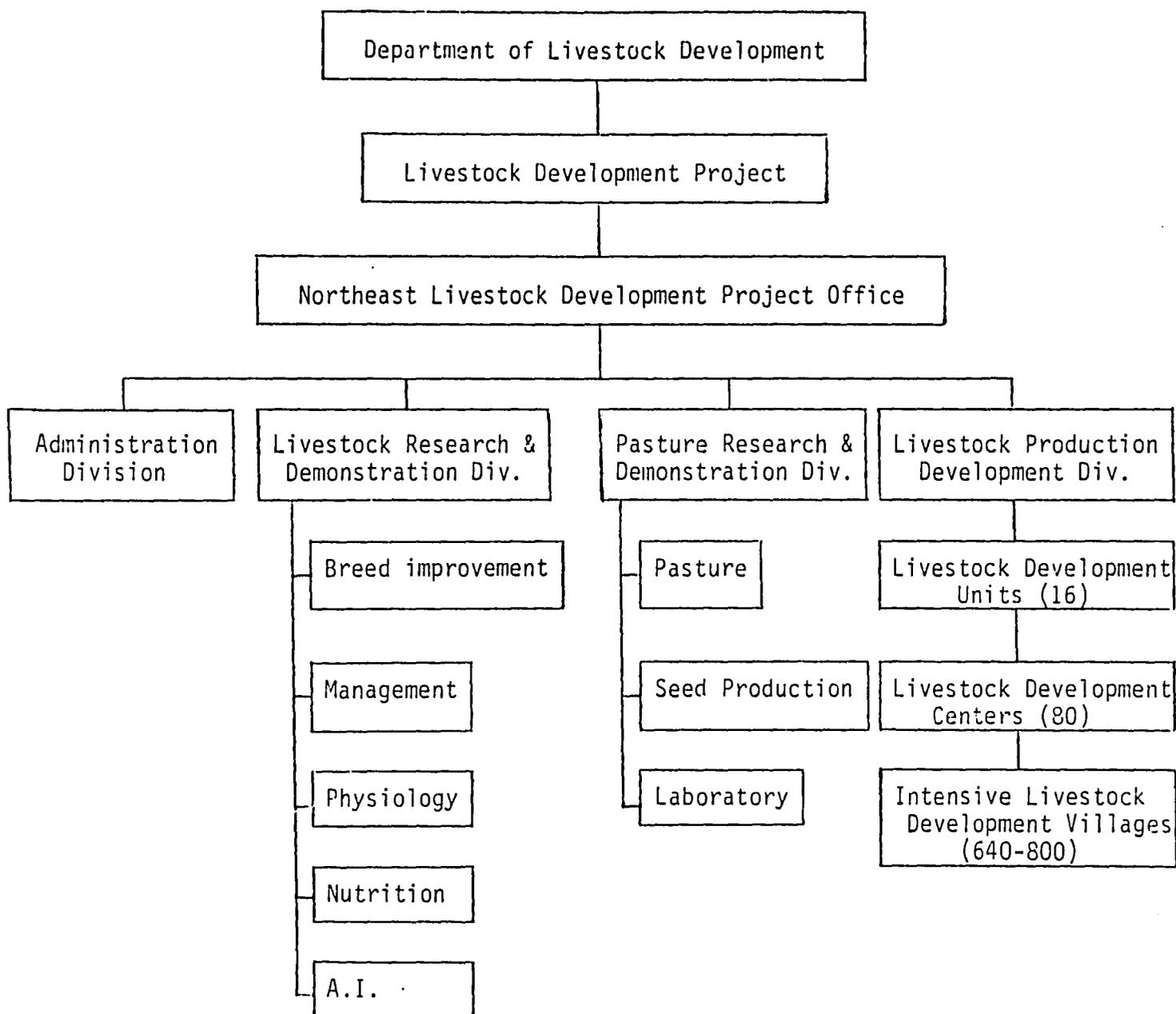


Figure 5.2 Organizational diagram of the Northeast Regional Livestock Development Project as of March, 1982.

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Summary, Constraints, Conclusions

The institutional analysis indicates there is a well-developed government infrastructure in place. However, it needs some reorganization in structure and programs, with considerable more emphasis on training and program support.

It was noted earlier that the DOLD is definitely not top-heavy with highly trained personnel. Of the professional staff (p.c. 3 and above) of some 1,891 people, there are presently only 4 PhDs. By contrast, the department of Animal Science at KKU has 13 PhDs in a staff of 25 people. The DOLD is extremely selective in sending people for continuing education, and relies more heavily on in-service training for upgrading technical competence.

Another situation having historic roots in the DOLD is the relative program emphasis given to veterinary versus animal husbandry work. There is no question that veterinary programs in the past received major emphasis but, it appears that the Department's field activities, particularly the NELDP, bring it increasingly into contact with the full range of development problems, and the apparent controversy of emphasis or balance between the two is becoming less relevant. The lack of production emphasis appears to be a constraint in the work of both major groups.

For various reasons, there has been a tendency for all RTG personnel, especially the better-trained and more promising people, to leave field positions and migrate to Bangkok. This pattern becomes a constraint when the best minds in the Department lose touch with the real concerns of their constituents. Khon Kaen city now has nearly all the amenities of Bangkok, so the pressure for migration out of the Northeast may be less than in the past.

Another constraint is the legal system which has very little, if any, punishment for stealing livestock. Consequently, producers must stable their cattle and buffalo under their houses at night, and carefully guard them during the day. This fear of "camoy", as stealing is called, raises both labor and feedstuffs costs, and effectively precludes many improved management practices from being initiated.

There is considerable information about causes of mortality, but the diagnostic laboratory at Tha Phra is not nearly capable of monitoring the actual causes of death. Field samples are usually autolyzed and thus not useable, and various culture media and test reagents are not available. There are delays and communication problems in disease identification that hinder smooth transition from the time help is requested until it is received. Many disease prevention controls are extremely difficult to control in developed countries and nearly impossible to effectively carry out in Thailand. For example, under the present scheme there is no monitoring to be sure cattle identified as TB and brucellosis reactors are disposed of properly. They often go into commercial traffic or through ordinary slaughter operations with concomittant human exposure.

There are no legal private abbatoirs in Thailand because public policy essentially will not permit them. As a result, it is estimated that at least 70 percent of bovine and swine are illegally slaughtered with attendant difficulties and inefficiencies for producers, and health and cost drawbacks for consumers. Uncertainty exists as to whether government intends to allow agri-business to grow, or whether they wish to maintain what is essentially a paternalistic attitude toward farmers.

There is a definite shortage of well trained extension and other service related people in the field of animal agriculture. In fact, there are probably very few people in the country who can assemble, evaluate and

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present a coherent analysis of animal production. These aspects include health, feeds and feeding, breeding, economic, agronomy and the way in which livestock fit into crop production.

The loose relationship between government agencies results in overlap of services in some instances, and lack of them in other cases. For example, there is a Department of Extension in the MOAC, and another Division of Extension within the DOLD. There is a Division of Artificial Insemination in DOLD as well as provision of services by LDU's and LDC's. In terms of diseases, there are mobile units from the diagnostic laboratories in the Division of Disease Control, as well as from clinics under the Division of Veterinary Service. Either of the agencies can carry out a vaccination program, do investigative work, and collect samples. In brief, there is a redundancy of programs with resultant high administrative and operational costs, and frequent failure to meet targets, goals and client's needs. There is a major drive to produce and distribute vaccine, but limited knowledge of disease and parasite prevalence, incidence, and on cost-benefit relationships. Even if there were knowledge, there are only limited supplies of anthelmintics and antibiotics. Funding for research is almost non-existent.

Another constraint at government level is the management of Northeast livestock stations. The result is inordinately high costs per unit of output and little demonstration effect to farmers. For example, weaned calf crops average 40-50 percent when it should be 70-85 percent. To a large extent, the difficulty lies in the system itself and not in the managers, as stations are required to return all proceeds from sale of animals to the national treasury. They are funded according to the number of animals they have so a vicious circle exists as station managers are forced to maintain as many cattle and buffalo as possible, which means very little culling of animals with low reproductive capacity. The result is disastrous as culling is the foundation for any management program. Just solving this problem alone could increase calf crops by 25-35 percent.

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PART VI. DEVELOPMENT STRATEGIES

Overall Statement

Previous sections of this report set out in detail the status of the livestock industry in Thailand and the Northeast; summarized the major details governing production, consumption, distribution and pricing of livestock and livestock products; analyzed the institutional support to the livestock industry by the RTG; described the economic status of Northeast Thai farmers; and evaluated constraints limiting the productivity of the livestock sector. This information serves as the basis for developing an overall project strategy, statements of a strategy on each of the major project components, the project design criteria, and the individual project components.

The overall strategy is one of improving livestock-related services to clients in the Northeast. More specifically, it is to assist Thailand develop and transfer component technology for small farmers and livestock producers in the Northeast to allow them to take full advantage of emerging market opportunities. The major focus is on water buffalo and cattle.

The target clients are small farmers in the Northeast relying on rainfed agriculture as their primary livelihood. Project design has proceeded by first making a close examination of farmers production practices, farm and village-level constraints, farmers' needs and the types of institutional support required to solve these problems. Institutional needs required to effectively focus on these problems were reviewed only after these farm level problems were clearly identified.

Northeast farmers have traditionally purchased very few inputs for their livestock operations. But, the macro-economic situation is changing rapidly in the Northeast as the region develops economically, and all indications are that this process will continue. Bovine husbandry in

particular can be expected to be more profitable as population and net income continue to grow, thus increasing the demand for beef. A part of the overall strategy is thus to determine the optimal input/output relationships in an economic sense, and the physical factors associated with them.

The institutional structure for provision of services to Northeast clients is essentially in place, at least in terms of physical facilities, although there are many remote areas which have virtually no service, and will receive only minimal service due to lack of DOLD personnel and facilities. The major constraint seems to be one of organization, direction, economic resources, and training to take full advantage of the existing framework.

Taking into account farm level and institutional factors, criteria for project design were outlined. These include:

1. The project should focus on strengthening existing institutions rather than creating new ones. Modifications would be suggested where they would improve the delivery of services and goods.
2. The project must have a sharp focus on existing production systems with high potential for improvement.
3. The project must focus on a few strong projects to develop component technologies and field testing programs.
4. The project must develop the institutional capacity of the Department of Livestock Development to continually modify and evaluate the technologies being generated for livestock producers, and to effectively transfer technology to the clients.

5. The project must focus on production systems and potential technologies compatible with emerging market opportunities for livestock and livestock products.
6. The project should, where feasible, support and encourage the development of the private livestock input sector.
7. The project should, where feasible, integrate its activities with other RAI components, particularly those with a village focus.

The overall project focuses on four main activities necessary to achieve the project strategy; institutional development, breeding programs, nutrition, and health.

Institutional Development Strategy

Thailand has already made large investments in public sector infrastructure for livestock development. The strategy of the proposed projects is to improve and build on previous projects and current infrastructure. The return from further investment should be high through better utilization of accrued human and material capital. Failure to continue and strengthen what has been started would abort and waste the existing investment.

Firstly, it is proposed to provide support for expanding the role of the Northeast Livestock Development Project and formalizing its role as an integrated regional planning and action unit within a Division in DOLD. The suggested modified administrative structure for this project is shown in Figure 6-1. Administrative oversight and technical specialists will be provided by the DOLD with the Division of Animal Husbandry acting as

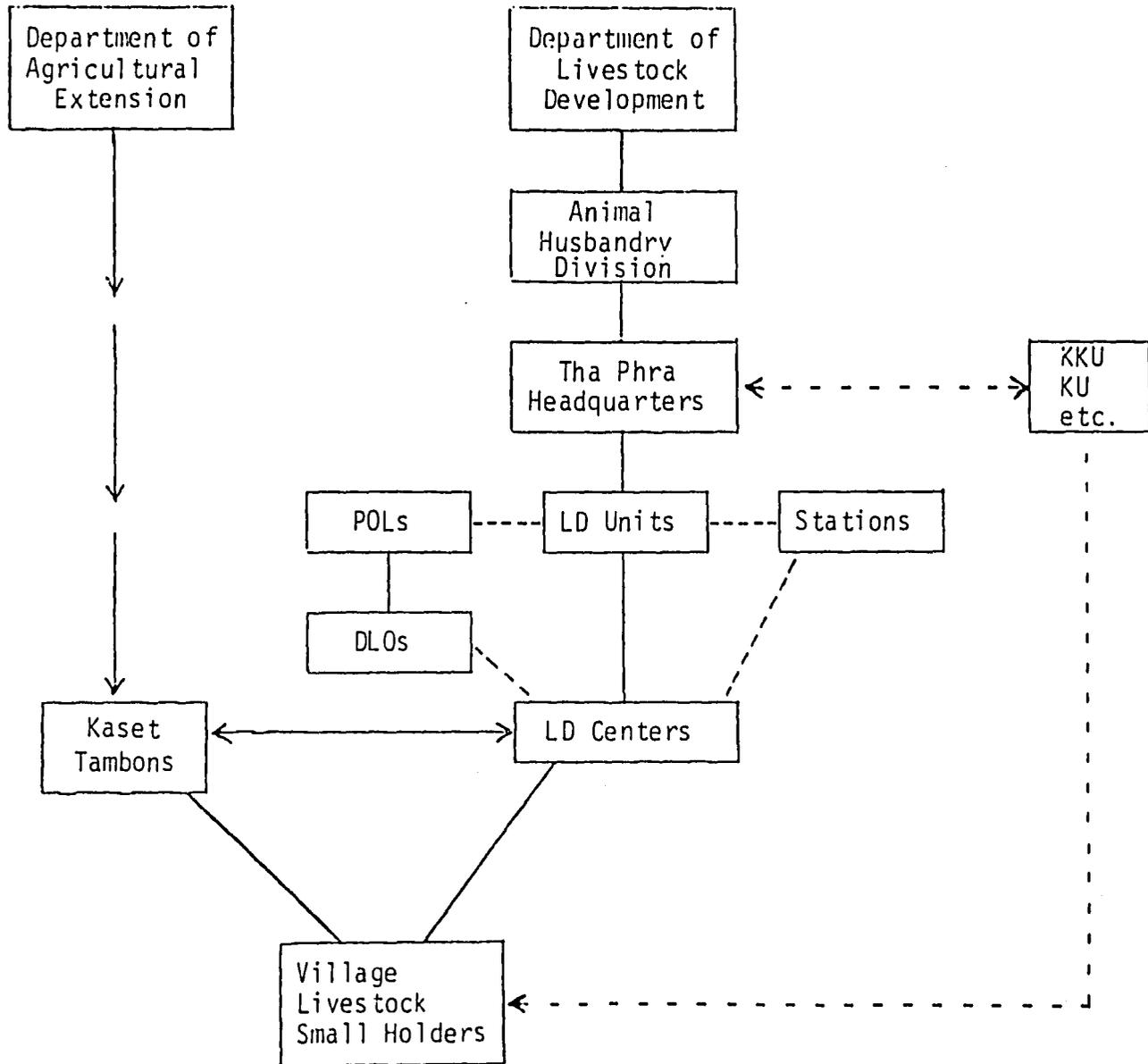


Figure 6.1 Proposed institutional framework for the Northeast Livestock Development Project.

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Breed Improvement Strategy

Statement of the Problem. Decreasing per capita supply of bovines and apparent decline in quality of genetic resources for buffalo are breeding-related problems that are reaching critical levels in the Northeast.

Strategy. The strategy for alleviating the above problems is to (1) improve the effectiveness of artificial insemination service to villagers and (2) expand and improve sources of high quality cattle and buffalo.

The following action programs will implement the strategy:

1. LDU's and LDC's will be strengthened to enable their A.I. services to more effectively reach village herds.
2. A regular and adequate supply of frozen semen from Brahman, Holstein-Friesian, swamp buffalo and Murrah buffalo will be established at Tha Phra headquarters.
3. The Tha Phra, Surin and Lamphyakhleng livestock stations will be improved by management training and their programs modified to become bases for supplying high quality breeding buffalo and cattle to small farmers through enlarged production testing programs.
4. The programs of LDU's and LDC's will be modified and strengthened to enable them to carry out on-farm breed improvement programs to expand readily available sources of high quality animals for small farmers. Selected villages will be used as nucleus centers for on-farm testing and management training.

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A major component of the breeding projects is training of personnel at the stations, LDH's and LDC's in (a) animal husbandry practices, (b) the method for carrying out the improved breeding program and (c) the way in which an integrated research and extension village level testing program can be carried out. In addition, a training program for participating farmers will be instituted.

Nutrition

Statement of the Problem. Bovine feed is frequently in short supply in Northeast Thailand during both the wet and dry seasons. Further, there is virtually no understanding of the delicate economic and physical relationships.

Strategy. The major thrusts of the project will be to

1. increase forage production;
2. improve utilization of agricultural by-products and wastes;
and
3. increase the efficiency of feed utilization through mineral supplementation.

The forage establishment work on private lands undertaken by the Livestock Development Project will be expanded, monitored, and refocused as needed. Emphasis will be on integration of forages into cropping systems and on rice bunds, roadsides and scrub forests. Distribution of *Leucaena* shoots should be broadened in scope. Research and training in production of hay and silage may be undertaken.

Agricultural by-products and wastes constitute an enormous feed resource in Thailand. This resource will be improved by supplementation with feeds which supply nutrients found deficient in the by-products, and by selected treatments which improve the digestibility and utilization of the by-products. Fortunately, the technology is simple and easy to apply. Therefore, the thrust will emphasize immediate application.

Thai scientists have demonstrated the necessity of phosphorus and certain trace minerals for gains and well-being of cattle and buffalo under controlled conditions. It is now proposed that the value of phosphorus and trace minerals be tested over a wide variety of farming conditions in Northeast Thailand. Mineral mixtures will be given to selected farmers in a number of villages and the animals will be observed and compared to control animals which will not receive the minerals.

In addition to the above major thrusts, there will be nutrition projects, run concurrently with performance testing on stations, to determine feasibility and profitability of various systems of accelerated bovine production.

Animal Health

Statement of the Problem. There is an infrastructure within the DOLD designed to control livestock diseases, but only limited test systems are available through the diagnostic laboratories. Further, an inefficient linkage exists between the small holder and the government official to whom a disease condition can be reported. It is widely recognized that important diseases must be contained or their effects neutralized but, due to a lack of surveillance data, judgments about control are based on simple opinion. Even though an infrastructure exists for disease diagnosis, it operates at a very low level of efficiency due to little diagnostic capability and inadequate interdivisional sharing of responsibility. In effect, lack of communication is a chief problem.

It is generally agreed that enhancing bovine reproduction is a top priority area for the Northeast. However, while a great deal of attention is being given to preservation and delivery of bull semen, there has been a serious lack of attention given to health of the female reproductive tract. The result is wasted trips for rebreeding, holding of females that are unproductive, and unnecessarily long calving intervals.

Strategies. A short (6 months or less) survey of livestock diseases coordinated by the Tha Phra Veterinary Diagnostic Center will be carried out to determine the problem areas from which priorities can be established. Then, a project for control of livestock diseases will be effected based on streamlining the DOLD infrastructure with the fulcrum being the Tha Phra Veterinary Diagnostic Center. The emphasis will be on improving the laboratory with more and better equipment, provision of improved testing techniques, and training of personnel. In addition, training will be provided to farmers, LDC and Kaset Tambon agents, DOLD livestock officers and others in the control of diseases.

The concept that animal health is a preventive as well as clinical operation is especially borne out in the strategy to improve bovine reproduction. Here, training programs for all related personnel from farmers to DOLD administrators will be carried out to show how and why animal management can be integrated with veterinary practices. These programs will be a coordinated effort between the Tha Phra headquarters staff of the Livestock Development project, and appropriate disease related divisions of DOLD.

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PART VII. PROJECTS

INSTITUTIONAL SUPPORT

Project No. 1

Title. Improvement of the Extension and Technology Transfer Roles of the Original Northeast Livestock Development Project.

Problem Statement. While the institutional base for the Northeast Livestock Development Project (LDP) established under a World Bank loan (terminated June 30, 1982) is in place, there is considerable need to expand the services provided to farmers through this network of centers beyond artificial insemination to include improved forage production, better animal health services, as well as upgrading the reproductive performance of cattle and buffalo.

Objectives. Develop an organizational structure for the LDP which will effectively integrate it within the larger DOLD structure.

Provide an institutional framework for expediting integrated farming research.

Provide graduate degree training for technical staff and future administrators of the project.

Improve the effectiveness of livestock stations in the Northeast.

Improve communication of technology transfer to village farmers.

Develop an efficient working relationship between Kaset Tamhon and LDC agents in villages.

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The previous LDP objectives of raising small-holder productivity through improved access to breeding stock, forage propagation materials, and animal health services will be continued in this project.

Implementation. The recommended organizational structure (Figure 6.1) will be put in place as soon as possible after start-up of the project. Management will be shared by American and Thai (P.C. 7) co-managers for the first three years, after which there will be a Thai manager only. Regular staffing of Thai positions will be through the DOLD budget. Consultants, training, research and special material costs will be funded by the RAI project. The Manager(s) will oversee all other RAI/livestock activities (2-14), as well as this activity.

Ten M.S. and two Ph.D. degree scholarships will be funded. The M.S. students will do their course work at one of the Thai universities and conduct their research on village-related problems. The Ph.D. studies will be done in American universities and the research will be done, where feasible, in Thailand on important problems of the project. Outstanding LDC personnel holding vocational education certificate will be encouraged to finish their studies for B.S. degrees.

Initial and periodic animal production training sessions will be held for LDU, LDC, and Kaset Tambon staff, and for project administrators and subject matter specialists.

Problems of managing livestock stations will be studied in depth. Consultative assistance will be provided to find how the stations can, within budget constraints, do a better job of animal husbandry as well as utilize their resources more efficiently. Training sessions for station personnel will be developed if deemed appropriate.

To improve extension communications, the project will provide equipment and a consultancy and training to produce and use video tapes and other communication methods on integrated farming technology. Three play-back units plus off-road vehicles will be provided. Each unit will have a permanently assigned crew, and will cover a specific geographic area on a route to be coordinated by the LDU and LDC staff.

Project managers will have, in addition to their line-item budget, a discretionary account to be used for non-specified development activities. These might include, for example, funding for work on draft animal harnesses, or material costs for special research work in villages.

Cooperating Agencies. All Divisions within the DOLD, the Department of Extension in the MOAC, and various universities.

Time Frame. Begin at the project's inception and run for the entire length of the project, except the M.S. and Ph.D. Training which will begin on the third year of the project. The studies will begin later in the project so that recipients will make a contribution early on, so they can understand their mission and, when return be better prepared to integrate themselves in the project's activities, and to provide competition and an incentive among employees for the scholarships.

Budget

I t e m	Y		E		A		R		Total
	1	2	3	4	5	6	7		
(US\$ 1,000)									
1. Personnel									
a. Project co-manager, U.S.	100	100	100	-	-	-	-	-	300
b. Consultants & trainers									
(1) for agent workshops: 12 man-months(mm) per year, \$1,000/mm, Thai	12	12	12	12	12	12	12	12	60
(2) for administrative workshops, \$1,000/mm, 2 mm/yr, Thai	2	2	2	2	2	2	2	2	10
(3) Communications specialist(s) for preparation of extension materials & training, \$10,000/mm, U.S.	60	10	10	10	10	10	10	10	100
(4) Various specialists for station management study and direction of identified and forthcoming projects. U.S. and Thai	30	30	30	30	30	30	30	30	150
(5) for preparation of extension materials, Thai	10	10	10	10	10	10	10	10	50
2. Materials and Equipment									
a. Materials for agent workshops @\$10/agent x 300 agents x 2 sessions per year	6	6	6	6	6	6	6	6	30
b. Materials for administrator and SMS workshops*	2	2	2	2	2	2	2	2	10
c. Equipment & materials for communications production	45	5	5	5	5	5	5	5	65
d. Mobile communications units, 3 ea., probably to include 4 WD vehicle (modified), tape player w/amplifier and screen, small generator, and replacement parts	65	2	2	2	2	2	2	2	73

* SMS = Subject matter specialists

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Budget (cont.)

I t e m	Y		E	A	R	Total
	1	2	3	4	5	
	(US\$ 1,000)					
3. Training Costs						
a. Ph.D. studies, 2 each approx. \$1,600 per man-month in US plus travel costs	-	-	50	30	30	110
b. M.S. studies, 10 each, @\$5,000, including some but not all research costs	-	-	20	20	10	50
c. Technical training for LDU & LDC staff: per diem for 300 people, 6 days/yr., \$10/day	18	18	18	18	18	90
Travel expenses for 300 people, 2 workshops/year, @\$15/person/workshop	9	9	9	9	9	45
d. Training of Kaset Tambon agents: per diem for 3 days per year @\$10/person/day for 300 agents	9	9	9	9	9	45
Travel expenses @\$15/person per workshop	4.5	4.5	4.5	4.5	4.5	22.5
e. Technical training for SMS staff at Tha Phra or elsewhere in Thailand	5	5	5	5	5	25
f. Administrative training of project staff, one session per year for 60 persons, including travel	8	8	8	8	8	40
g. Training abroad for communications specialists; total of 6 mm in first year for 3 people						
- Travel @\$3,500 each	10.5	-	-	-	-	10.5
- Per diem @\$50/day	9	-	-	-	-	9
4. Discretionary budget for research and development	50	50	50	50	50	250
Total	455.0	282.5	352.5	232.5	222.5	1,545.0

Expected Output. Smoothly operating project integrated within the DOLD institutional framework, and capable of continuing within that framework as the focal point of livestock research and extension activities in the Northeast.

Conditions. Agreement by DOLD to the organizational structure and continued funding of necessary staff.

INSTITUTIONAL SUPPORT

Project No. 2

Title. Support for the National Buffalo Research and Development Center (NBRDC)

Problem Statement. Many international, regional and local institutions have proclaimed the need for scientific work towards improved productive performance of the Asian water buffalo. Thailand's NBRDC has already made valuable contributions to the knowledge base through excellent cooperative efforts between DOLD and the Thai universities, and could do much more if it was provided a larger research and development budget. The project deserves support for several reasons, the prime institutional one being that it is a functioning, cooperative project between the DOLD and Thai universities.

Objectives. Strengthen the NBRDC research activities.

Produce appropriate technologies for improving buffalo production by small-holders.

Produce and maintain superior buffalo germ plasm for distribution in Thailand and for exchange among Asian countries.

Implementation. Funds provided to the NBRDC will be allocated according to decisions by that group's Board of Coordinators. The LDP manager(s) will be on the Board. More detail about the Center and its activities is provided in Appendix 6.1

Likely activities for which the funds will be used include:

Support of breeding herds at the Surin station.

Reproductive physiology and AI research.

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- Village-level production research.
- Improved husbandry research.
- Feeding and nutrition research.
- Veterinary and health research.

Some of these activities may be done by scientists from cooperating institutions in their own facilities, using project funds.

Cooperating Agencies. Kasetsart, Khon Kaen, Chulalongkorn Universities and other cooperating institutions.

Time Frame. Begin within first 6 months and continue for 5 years.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$ 1,000)					
1. Consultants, expatriates at 4 mm, \$10,000/mm	20	-	-	20	-	40
2. Research equipment	10	10	10	10	20	60
3. Materials and supplies (for publishing annual report and publication)	2	3	4	5	5	19
4. Vehicles						
2 minibuses	10	10	-	-	-	20
6 motorcycles	2	-	2	-	-	4
1 pick-up truck	-	8	-	-	-	8
5. Seminar and workshop (costs of organizing)	-	4	-	-	5	9
6. Research fund	<u>36</u>	<u>45</u>	<u>64</u>	<u>60</u>	<u>70</u>	<u>275</u>
Total	80	80	80	95	100	935

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- Expected Output.
1. Fifty to sixty highly selected buffalo bulls per year will be available for breeding and/or semen collection.
 2. Technology for improving buffalo calving rate from the current 35-55 percent up to 60-70 percent.
 3. Improved genetic potential for weight gain of buffaloes.

Conditions. None

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BREEDING
Project No. 1

Title. Expansion of Improved Crossbred Bovine Breeding Stock via
Performance Testing

Problem Statement. It appears that the size of buffalo and cattle are decreasing due to negative selection of larger animals for work, and through inbreeding depression and nutrition. In addition, there is a chronic lack of improved buffalo and cattle bulls at the village level, thus contributing to low calving rates and longer calving intervals.

Objectives. Expand the number of performance-tested buffalo and Brahman bulls available to villagers.

Select superior bulls for collecting semen for artificial insemination.

Implementation. A revolving fund using a working capital account will be developed so two stations, Tha Phra and Lamphyakhleng can purchase promising high grade (F_3 and higher), 8 month old Brahman bull calves weighing about 150 kg. These stations, and one at Surin, will also test superior buffalo bull calves. A test period ranging from 8-12 months will be tied to postweaning nutrition trials (see nutrition projects). Superior animals will be sold either directly to farmers or through auctions or similar methods. Buffalo bulls judged to be inferior will be castrated and sold for draft purposes. Inferior Brahman bulls will be sold to slaughter. Calves from the station's breeding herds will also be included in the performance testing trials.

Cooperating Agencies.

1. The three stations at Tha Phra, Lamphyakhleng and Surin.
2. Division of Animal Husbandry of DOLD.
3. Kasetsart and Khon Kaen Universities.

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Time Frame. This project will begin within the first 6 months and will be funded through RAI for duration of the RAI project.

Budget

I t e m	Year 1 Only (US\$1,000)
Working capital for animals only at project's inception. 4,000 Baht per head x 1,700 head	\$296
Improvement in animal feeding facilities	50
Auction or holding yard/market facilities	<u>10</u>
Total	\$356

Proceeds from sale of animals will be deposited in the working capital account and used as a revolving type fund. Feed is included in the nutrition projects.

Expected Output. Sale of 1,500 performance tested hulls to farmers annually.

Sale to slaughter or draft of 115 head annually (includes 5 percent death loss).

Sale of 100 station-raised performance tested bulls.

Calf crop of animals sold to villagers improved by 10 percent.

Increased weight of progeny sold by farmers of 10 percent.

Conditions. Stations and Division of Animal Husbandry must agree to management plan set forth by advisors.

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BREEDING
Project No. 2

Title. Performance Testing and Management Training on Cattle in Villages

Problem Statement. Cattle in the Northeast vary greatly in terms of reproductive performance, size, and weight gain or loss. Most improved management principles are relatively simple, but are difficult to teach except by the demonstration method.

Objectives. Develop a means of performance testing which can be used at the village level to evaluate and select better quality cattle.

Compare and contrast, using economic criteria, performance testing and associated feeding trials at the village level with tests at government stations.

Increase the number of good breeding animals.

Integrate the teaching of improved management techniques with the testing program.

Integrate cattle feeding trials with performance testing via an on-farm research and extension mode.

Implementation. The project manager, in conjunction with subject matter specialists, Kaset Tambons, and LDC technicians will identify about 300 farmers who will each receive about 5 head of bull and heifer calves on a contract basis. The project will buy from area farmers the 7 - 8 month old weaned calves, weighing about 150 kilos each, using money designated as "working capital" which will operate like a revolving fund.

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At this point it is not possible to determine the number or location of participating villages, but one selection criterion will be using villages in which an association of livestock raisers can be formed. These associations could supervise record keeping, standardization of management and feeding practices, etc. To assure adequate control, the leader might be a non-member such as a teacher, priest or village chief. It is also anticipated that other selection criteria of farmers and villagers would be their convenient accessibility by LDC personnel, and interest of local LDC Kaset Tambon technicians.

Some requirements of participating farmers might be their agreeing to be responsible for the animals and willingness to follow all testing and feeding procedures, and their understanding that animals would not be sold before the test period is completed. The incentive to participate in what is essentially a "contract growing" operation would be a price per kilo which would remunerate them for their labor and any specified costs incurred. All direct expenses such as purchased feed and medicines would be paid by the project. The farmers would receive their payment when the animals are sold. It is anticipated that the raising of breeding stock and animals for slaughter will be sufficiently lucrative that the working capital fund will be self-sustaining and perhaps even increase, and that the program will be sufficiently successful that individuals who have their own animals would enroll in it. In fact, a measure of success will be the extent to which the private sector becomes involved in sale of performance tested animals.

Animals selected for the program will either be horn-hot or freeze-branded for identification purposes. Various rations and management schemes will be developed. Examples are pasture in combination with cassava chips, dry leucaena leaves and complete supplements. There will be two phases, growing and finishing. The growing phase will be completed when the animals reach about 14 months of age. At this time a determination will be made about which animals will be finished for slaughter, and which will be grown for breeding stock.

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These trials will also be the mechanism for carrying out the mineral tests and village level feeding trials described in the section under nutrition projects. The feeding trials will correspond with the ones at stations described in the project on performance testing at DOLD stations. The same criteria for determining animals to be sold for slaughter will be used for both projects.

It is suggested that animals be sold either via individual bargaining in a few holding yards on selected sale days, or via auctions. In any event, it is recommended that the testing project be used as a means for institutionalizing large scale livestock markets.

Cooperating Agencies. Tha Phra headquarters, Division of Animal Husbandry of DOLD, Kasetsart and Khon Kaen Universities

Time Frame. This project will begin within the first year and will be funded by RAI for the duration of the RAI project.

Budget

I t e m	Year 1 Only (US\$1,000)
Working capital for animals and feed at project's inception, 8,000 Baht per head x 1,500 head	522
5 portable weight scales at \$3,000 each	15
Supplemental feed and miscellaneous supplies	<u>25</u>
Total	562

Expected Output. Sale of 1,300 performance tested bulls and heifers to farmers annually.

Sale to slaughter of 125 head annually.

Calf crop of animals sold to villagers improve by 30 percent (because of females included in the animals tested).

Increased weight of progeny sold by farmers of 10 percent.

Training at least 1,000 farmers over a 5 year period in improved livestock production practices via this demonstration method.

Establishment of a village-level breeding stock raising industry and a village level cattle feeding industry.

Conditions. None.

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BREEDING

Project No. 3

Title. Improving the Crossbreeding of Buffalo and Cattle through Artificial Insemination

Problem Statement. There is a strong demand for crossbred (Holstein sires and native cows) dairy calves for Central and Southern Thailand. The Northeast has been identified as the resource area for raising replacement dairy heifers but, despite recent efforts by DOLD and DPO, the supply of heifers has been inadequate to meet demand. The major means for increasing the supply is via an expanded artificial insemination program. In addition to the need for dairy heifers there is demand for crossbred bulls and calves for fattening. Finally, there is a deficit of semen, and a cumbersome system for provision of it, at AI stations.

Objectives. Increase the number of crossbred buffalo and cattle for dairy, draft and beef production.

Increase the quantity and quality of AI semen.

Implementation. Murrah buffalo bulls (river type) will be imported to augment the existing ones at the Nong Kwang Livestock Breeding Station at Ratchaburi. Superior swamp buffalo bulls from the performance testing project will be assembled at the Tha Phra Station. Facilities at this station will be expanded to include a semen freezing and storage unit for the Northeast to eliminate the current practice of sending semen to Bangkok for freezing.

Superior Brahman bulls from the performance testing project will be maintained at Tha Phra. Holstein Friesian dairy semen will be brought from

DOLD in Bangkok and maintained at the station. Locally produced semen will be augmented by purchases from the United States. Semen collection and production will continue to be located at Tha Phra.

Cooperating Agencies. Bulls from the three stations at Tha Phra, Lamphyakhleng and Surin will be transferred to the Tha Phra station.

The agency in charge of the LDC's will be a cooperating agency.

Time Frame. This project will begin within the first 6 months and will be funded by RAI for the duration of the RAI project. At this time funding will be transferred to the DOLD budget.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Import of 30 Murrah bulls from Pakistan including cost of transportation	65	-	-	-	-	65
Import of 20 Brahman Bulls from the U.S. at \$4,000 each including transportation	80	-	-	-	-	80
Semen production unit	35	-	-	-	-	35
Semen production materials, 560,000 Baht annually for 5 years	20	20	20	20	20	100
Spare parts, gasoline and oil for 80 LDCs to augment government budget	<u>50</u>	<u>50</u>	<u>50</u>	<u>50</u>	<u>50</u>	<u>250</u>
Total	250	70	70	70	70	530

Expected Output. Completely meet the needs of the LDP for cattle and buffalo semen.

Improve the calving rate of females bred using AI by 10 percent.

Reduce the calving interval (now estimated at 18 months in buffalo and cattle) by 10 percent in females being bred by AI.

Increase the number of females bred by 25 percent.

Conditions. None

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BREEDING
Project No. 4

Title. Expansion of Improved Native Thai Breeding Stock via Performance Testing

Problem Statements. Cattle indigenous to Thailand are still the predominant type found throughout the country despite a substantial program of introduction, multiplication and dissemination of Brahmans. It appears that native cattle will continue to make up a substantial proportion of the national herd in the foreseeable future. In addition, research in many countries indicates that native cattle may more economically viable in certain farming systems. Despite widespread recognition that native cattle should be selectively improved in an organized breed selection program, there has been no attempt to do so in Thailand. Furthermore, it is thought that the mature size of indigenous cattle may be declining through a process of negative selection by villagers, i.e. castrating the largest animals. Significant improvement in genetic potential for size and growth of indigenous cattle in the Northeast can be achieved by provision of high quality breeding bulls to villages.

Objectives. Expand the number of performance tested native cattle available to villagers.

Develop a program of testing and selecting native cattle which maximizes growth and reproductive potential.

Compare and contrast Brahman with native cattle in a performance testing program based on economic criteria.

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Implementation. The Lamphyakhleng Station (or alternatively the Ubon Livestock Breeding station) will be used for holding the animals selected (on a one time basis) from all regions of Thailand per the following table:

Region	Males	Females
Northeast	10	200
North	4	80
Central	3	60
South	<u>3</u>	<u>60</u>
Total	20	400

Pre- and post-weaning gain of offspring will be the major selection criteria. Offspring will be performance tested in the nutrition projects. Superior offspring will be sold to villagers or saved for reproduction on the station. Poorer animals will be sent to slaughter.

Cooperating Agencies. 1. Division of Animal Husbandry, DOLD.

2. Kasetsart and Khon Kaen Universities.

Time Frame. This project will begin within the first 6 months and will be funded by RAI for duration of the RAI project. At the end DOLD should be assume funding.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Breeding Stock						
20-2 year old bulls at 7,000 Baht each	7	-	-	-	-	7
400-2 year old cows at 5,000 Baht each	87	-	-	-	-	87
Scale	5	-	-	-	-	5
Animal shelters	50	-	-	-	-	50
Pasture Improvement, 3,000 rai at 2,300 Baht/rai	300	-	-	-	-	300
Supplemental feed for 620 animals at 2 kg/day = 1,240 kg/day at 3 Baht/kg = 3,720 Baht/day or 1,357,800 annually for 5 years	<u>59</u>	<u>59</u>	<u>59</u>	<u>59</u>	<u>59</u>	<u>295</u>
Total	508	59	59	59	59	754

Expected Output. Sale of 175 performance-tested calves to farmers annually.

Sale to slaughter of 25 calves annually.

Increased weight of progeny sold by farmers of 10 percent.

Productive and economic comparative data for Brahman and native cattle.

Conditions. Stations and Division of Animal Husbandry must agree to management plan set forth by advisors, to fund other expenses not accounted for, and to fund the project on a continuing basis for at least 5 years after the RAI project is completed.

NUTRITION
Project No. 1

Title. Improving Village Level Forage Production

Problem Statement. Some aspects of the World Bank (NELDP) forage program were successful and should be improved, i.e., grass and legume growing on private lands (backyard and fields) and overseeding of general grazing areas such as upland scrub forest, rice bunds, roadside, etc. Propagation of *Leucaena* in villages, using bare stems rather than seeds, should be continued on a larger scale.

Sesbania grandiflora is a valuable tropical tree legume which can be grown as is *Leucaena*; this will be an addition. There should be emphasis upon the growing of *Pennisetum purpureum* in some areas of the Northeast; it will also be an addition to the grass collection.

Objectives. Increase village level forage production by:

- a. Expanding the NELDP program on the growing of *Hamata*, *Siratro*, *Centrosema*, and selected grasses.
- b. Expanding the NELDP project to include *Sesbania* and *Pennisetum purpureum* (Napier grass) and to increase *Leucaena* production by transplanting nursery stock.

Demonstrate the value of leaves from *Leucaena* and *Sesbania* as a feed source to supplement low-protein forages during periods of feed shortages.

Increase the planting of *Leucaena*, *Sesbania* and *Hamata* on upland rice terraces.

Increase seed production of Hamata, Siratro, and Centrosema for oversowing both private and communal village lands.

Implementation. The project can start immediately since the LDU's and LDC's set up by the NELDP, along with six forage stations of the DOLD are in place. About eighty (80) selected villages will be used. The Hamata and exotic grass program will be expanded to as many upland areas as possible with the idea of demonstrating the value of these on a larger scale. Leucaena and Sesbania will also be started in nurseries and then transplanted to terraces and upland areas, especially waste lands and fence rows. The farmers will be shown how to use these to build "living fences". Guinea grass will be introduced in certain farms in dry areas and Napier grass in both wet and dry areas.

Cooperating Agencies. Division of Nutrition and Pastures in the DOLD, LDC, LDJ and Kaset Tambons. The DOLD agencies already in place (Division of Animal Nutrition - forage station, LDJ, LDC and the DOAE personnel.

Time Frame. 2 years with a thorough review to determine whether to continue.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Equipment and material						
Working capital for see production by farmers	100	50	-	-	-	150
Consultants						
3 mn of expatriates at \$10,000/mn	<u>20</u>	<u>10</u>	=	=	=	<u>30</u>
Total	120	60	-	-	-	180

Expected Output. Improvement of either net cash income or income-in-kind by at least 15 percent annually for farmer with bovine animals.

Conditions. None.

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NUTRITION
Project No. 2

Title. Mineral Studies on Bovine Animals

Problem Statement. Previous work by the Division of Animal Nutrition and other groups in the DOLD and universities indicates that mineral supplementation of bovine diets is beneficial. Therefore, all DOLD Livestock Stations use either steamed bone meal or mineral supplements which contain phosphorus and selected trace minerals (cobalt, copper, iodine, iron, manganese, selenium and zinc). But, at this time very little use is made of minerals by farmers, and it is now time to move this technology to selected villages for testing under farm conditions.

Objectives. Determine if mineral supplements are economically beneficial to the improvement of health and production of village cattle and swamp buffalo.

Measure the magnitude of the response under village conditions.

Implementation. In the initial stage, LDC personnel will choose villages and farmers in those villages to receive a mineral mixture. Two possibilities exist: use of the usual salt, bone meal and limestone mixture now in use at the livestock stations, or to use the Division of Animal Nutrition's special mineral mixture. In general, response to minerals is greatest in highly productive livestock systems. The village system is far from this, but response is expected in some situations.

The mineral mixture chosen will be given to selected farmers and it will be offered free choice to their animals when they are corraled at night. Cattle will be weighed twice yearly and continually monitored and observed

for general health, growth, and reproduction. The opinion of the farmers and the LDC workers will be the main evaluation criteria. It is realized that this approach is far from a quantitative one. The reasoning is this: if the response to supplemental minerals under village conditions is not apparent to the LDC observer and the farmer, there is not much likelihood of adding minerals to animal's diets being adopted.

The initial study should be limited to one village in each of the 8 tambons in the NERAD project. If response is found in any of these, the test could be expanded to cover other areas. If no discernible response is found anywhere, the project should be discontinued.

Cooperating Agencies. NERAD and Division of Animal Nutrition. Coordination will take place with the on-farm performance testing of buffalo and cattle.

Time Frame. 3 years and review. Funds are provided for 5 years. If the review is unfavorable, the money should be transferred to other nutrition projects.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$,1,000)					
Consultant - 2 man-months	20	-	-	-	-	20
Minerals	<u>35</u>	<u>35</u>	<u>35</u>	<u>35</u>	<u>35</u>	<u>175</u>
Total	55	35	35	35	35	195

Probable Outcome. 0 - 15 percent increase in gains.
0 - 50 percent improvement in health and condition if there are acute deficiencies.

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NUTRITION
Project No. 3

Title. Studies on Growing/Finishing Bovine Animals on Grass

Problem Statement. The Northeast has land resources which could be used to produce improved pastures for growing/finishing cattle and buffalo for the slaughter market, even though there appears to be a tendency toward a cow/calf system in the Northeast for producing feeder calves for other regions. But, at present there is no suitable research work to determine if bovines can be profitably grown and finished on grass post-weaning.

Objectives. Collect growth data on bulls grown for 12 months post-weaning on pastures in a growing program.

Collect growth and finishing data on breeding bulls kept on pastures for 13-24 months and then sold as breeding bulls or as slaughter animals.

Evaluate from an economic standpoint certain alternative production systems.

Implementation. This project is part of breeding project number 1. It is proposed that government livestock stations keep some bulls from the breeding projects on grass for 12 months and then sell these to the villagers for breeding stock. Other animals will be kept on grass for another 12 months, a total of 24 months on grass at which time they will either be sold for breeding or sent to slaughter. These two periods are considered as growing period (the first 12 months) and a finishing period (the last 12 months). As both of these phases need to be investigated, it is a fortunate situation that these tests can be made with little additional cost. The data will be analyzed for economic factors such as land utilization costs, returns per animal unit, cost of gain, etc.

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Cooperating Agencies. DOLD livestock stations, Division of Animal Nutrition, KU and KKU.

Time Frame. 5 years beginning in year 1

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$,1,000)					
Equipment and materials supplemental feed	30	30	30	30	30	150
Total	30	30	30	30	30	150

Output. The data can be used to indicate whether the Northeast should finish animals or furnish weaners or yearlings for finishing elsewhere.

We can put no estimate on the expected returns; however, the buying of weaner calves will create incentives for affected farmers to breed cows more frequently.

Conditions. None.

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NUTRITION
Project No. 4

Title. Finishing Bovine Animals on Rations Containing Agricultural By-products and Local Feeds

Problem Statement. The traditional usages of bovine, especially the buffalo, has been for draft. However, there is evidence of change, especially in cattle, toward a cow/calf program to produce weaned calves especially for fattening and slaughter. If this trend is real, then consideration should be given to finishing some bovines in this region for slaughter markets.

Implementation. The project will be coordinated with Breeding Project No. 1 and Nutrition Project No. 3 and will be initiated in close conjunction with them. The difference from Project No. 3 is that cattle under that project are fed only on grass and slaughtered at 24 months of age. In this project (No. 4) cattle will be fed on grass 18-20 months and finished on rations similar to these below, free choice, for 140 days. A least cost ration, using computer technology, will be used as the control ration.

Rations	1	2	3	4
Legume Hay*	+	+	+	-
Cassava Chips	+	+	+	+
Molasses	+	+	+	+
Urea	+	+	-	-
Rice straw	+	-	+	+
Corn	+	+	+	+
Leucaena Meal	-	-	+	+
Minerals	+	+	+	+
Rice bran	-	-	-	+

* Hamata, Siratro, and Centrosema can be used.

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Data on gains and feed efficiencies will be available as the animals will be weighed at the beginning and end of trials. Economic analysis of the data will be made, and the data can be compared to that obtained (see Project 3) when animals are finished on pasture alone.

Cooperating Agencies. DOLD livestock stations and Division of Animal Nutrition, KU and KKU.

Time Frame. Start in year 3 and end in year 5.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Feed	-	-	40	40	40	120
Consultant, Expatriate, 2 mm at \$10,000/mm	-	-	10	10	-	20
Total	-	-	50	50	40	140

Expected Output. As in Project No. 3, data generated will be of significant value in assessing system alternatives for bovines in the Northeast.

Conditions. None.

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NUTRITION
Project No. 5

Title. Improving Agricultural By-products and Wastes For Use in Bovine Feeding

Problem Statement. In paddy and upland crop production systems now employed in Thailand, much of the protein and carbohydrates in crop residues cannot be marketed as human food. These products are therefore used by farmers to feed their cattle and swamp buffalo. There is evidence that the efficiency of utilization could be increased by processing, by supplementation with feeds which add nutrients which are deficient in a particular residue, and by combining two or more crop residues to obtain a more complete ration.

The DOLD, Thai Universities (KU, KKU) and others have conducted research on the technology needed to use the crop residues, by-products and waste products in rations of livestock. With careful planning and selection some of these techniques could be tried in villages for possible village acceptance. The urea-silage method is the most promising at this time.

Objectives. Improve the utilization of rice straw for bovines by:

- a. Supplementation with high-quality feeds (Leucaena, Sesbania, cassava leaves, peanut vines, Hamata hay, backyard grasses, cassava chips, cracked rice and possibly rice bran)
- b. Use of simple chemical treatment (urea, salt and water) for making rice straw silage making. The project would use the method which KKU scientists have already tested.

Put together simple feeding systems for use in the villages.

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Mount an education and extension program for teaching the farmer to feed for production during periods of stress on animals, i.e., lactation, work, and last months of pregnancy.

Implementation. It is proposed that the work be carried out in NERAD villages. The project in the first objective can be implemented during the first and second years. The second objective can be implemented on a very limited scale during the second year. If it is accepted, the process will be expanded and use in more villages. The third objective should be initiated using video tapes, film strips, slides, etc. during the second year and then expanded.

Cooperating Agencies. DOLD units (Division of Animal Nutrition, LDU, LDC), DOAE, KU, and KKU.

Time Frame. 5 years.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Materials	10	10	15	10	10	55
Consultants, 1 mm for expatriate per year at \$10,000/mm	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>50</u>
Total	20	20	25	20	20	105

Output. Villagers can be expected to readily adopt the new practices to the extent that net incomes, or income-in-kind, improve 20-25 times for every dollar invested.

Conditions. None.

ANIMAL HEALTH
Project No. 1

Title. Improvement of Animal Disease Monitoring and Development of a Permanent Disease Surveillance System.

Problem Statement. Reliable data on the incidence and prevalence of the important animal diseases in the Northeast is not available. The key infrastructure needed for determining the incidence and precedence of animal diseases is an excellent diagnostic center which has strategically-located veterinary clinics, which can supply good samples for diagnosis and, in turn, provide excellent information feedback to the farmer producers. Both the diagnostic center in Tha Phra and the regional veterinary clinics need improvement in facilities and organizational structure for carrying out a survey of important animal diseases and for their continual monitoring.

Objectives. Improve the Tha Phra Veterinary Diagnostic Center so that diagnostic capability is strong and predictable.

Carry out a rapid survey not to exceed 6 months to identify the incidence of livestock diseases in the Northeast.

Develop a system of data organization, processing and tabulation which will permit easy retrieval and analysis.

Develop a comprehensive work plan for control of infectious diseases.

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Implementation. The Tha Phra Diagnostic Center will be improved with equipment purchases and personnel training. The equipment should be sufficient to meet all non RTG funded laboratory needs for the next 5 years. Purchase of mobile units will permit the disease survey to be carried out efficiently and effectively using current staff. Staggering equipment purchases will insure efficient use of it as the laboratory will be invaluable in long-term training and development activities as described in the next two projects.

Time Frame. Begin within first 6 months, with all disbursements of funds by year three. This process can be accelerated as deemed appropriate. The survey should be completed by the end of year one.

Cooperating Agencies. All divisions of animal health in the DOLD.

Budget. Following is an illustrative budget. A final determination of exact requirements will be made by the project manager and/or consultants.

First Year

I t e m	Cost (US\$)
Equipment	
Sonicator	1,500
Freezer - ultra low temperature	4,000
Leminar floor hoods (3) 3x5,000	15,000
Micropipet (2) 2x30	60
Shaker bath (3) 3x300	900
Microtiter plastic plates (100)	2,000
Water bath	300
Eppendorff Pipet set (3) 3x250	750
Mixer	100
Blender	300
Deionizer	400
Automatic Pipet	450
Columns for chromatography	2,500
Reagents	2,000
Reusable supplies	
Glassware	5,000
Sample tubes	2,500
Disposable pipettes	2,000
Sub-total	<u>39,760</u>
Personnel	
Training	
Short term (non degree) travel (technicians or veterinarians)	21,500
M.S. Fellowships (students to U.S.) (2) x 15,000	30,000
M.S. Fellowships (students to study in Thailand) (2) x 15,000	30,000
Mobile Unit	
Isuzu diesel van (4) 4x10,000	40,000
Microscope (4) 4 x 2,000	8,000
Refrigerator (4) 4x1,000	4,000
Water tank (50 l.) (4) 4x300	1,200
2 way radio (4) 4x1,500	6,000
Medium size truck (2) 2x3,000	6,000
Medical instruments (2) 2x3,000	6,000
Obstetrical instruments (2) 2x1,000	2,000
Gasoline (1,000 gal/car) 6 cars	6,000
Office supplies	
Typewriter	1,000
Xerox machine	6,000
Audio visual equipment	1,500
Total	<u>208,960</u>

Budget (cont.)

Second Year

I t e m	Cost (US\$)
Equipment	
Fraction Collector apparatus and recorder	7,500
Autotechnicon	5,000
Electrophoresis equipment	2,000
Freezer - ultra low temperature	4,000
U.V. microscope	6,000
Inverted microscope/with camera)	2,000
Water bath	300
Mixers (2) 2x100	200
Columns for chromatography	2,500
Peristaltic pump	1,500
Reagents	2,000
Reusable supplies	
Glassware	5,000
Sample tubes	2,500
Disposable pipets	2,000
Sub-total	<u>42,500</u>
Personnel	
Training	
Short term (non degree) travel (veterinarian or technicians (5) x 4,300	21,500
M.S. Fellowship (Thai students) (2) x 1,500	3,000
M.S. Fellowship (U.S. students) (2) x 15,000	30,000
Mobile Unit	
Isuzu diesel van (2) 2 x 10,000	20,000
Microscope (2) 2 x 2,000	4,000
Refrigerator (2) 2 x 1,000	2,000
Water tank (50 l.) (2) 2x300	600
2 way radio (2) 2 x 1,500	3,000
Medium size truck (4) 4 x 3,000	12,000
Medical instruments (4) 4 x 3,000	12,000
Obstetrical instruments (4) 1,000	4,000
Gasoline (1,000 gal/can) 12 x 1,000	12,000
Office supplies	
Typewriter	<u>1,000</u>
Total	<u>167,600</u>

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Budget (cont.)

Third Year

I t e m	Cost (US\$)
Equipment	
Shaker bath (2) 2x300	600
Atomic absorption spectrophotometer	10,000
Mixer (2) 2x100	200
Reagents	
Reusable supplies	2,000
Glassware	2,000
Sample tubes	500
Disposable pipets	1,000
Personnel	
Training	
M.S. Fellowships (Thai students) (2) x 15,000	30,000
M.S. Fellowships (U.S. students) (2) x 15,000	30,000
Mobile Unit	
Isuzu diesel van (2) 2x10,000	20,000
Microscope (2) 2x2,000	4,000
Refrigerator (2) 2x1,000	2,000
Water tank (50 l.) (2) 2x 300	600
2 way radio (2) 2x1,500	3,000
Medium size truck (2) 2x3,000	6,000
Medical instruments (2) 2x3,000	6,000
Obstetrical instruments (2) 2x1,000	2,000
Gasoline 2,000 gal/car (16)	32,000
Office supplies	
Typewriter	1,000
Audio visual equipment	1,500
Total	154,400

Fourth Year
No cost

Fifth Year
No cost

Outputs. Strengthening of the Tha Phra facility will permit projects two and three to be viable. These projects, which include education of the herdsman and government agents, are vital for herd health improvement.

The survey will be used to design complete animal disease control priorities.

The survey will serve as the basis for a computerized record-keeping system that will permit rapid and accurate study of disease problem areas as they develop.

Estimated benefits presented in Appendix 7.2, indicate that savings from losses as a result of the program should range between 34 and 170 million dollars annually. With a total project cost of about \$1.3 million for animal health, this means the potential benefits should fall between \$25 and \$130 for each dollar invested. Regardless of the assumptions, it is evident that the potential cost benefit ratio is quite high.

Another way of estimating benefits is by evaluating the likely improvement in detection of diseases by the Tha Phra Diagnostic Laboratory as a result of the project. These estimates, by disease, are given in Appendix 7.3.

Additional observations about animal health are given in Appendix 4.1.

Conditions. See projects 2 and 3.

ANIMAL HEALTH

Project No. 2

Title. Strengthening Field Clinics for their Role in Disease Control.

Problem Statement. At present there is only a loosely knit, randomly moving mechanism of section divisions and departments in the sequence of events from disease recognition to management and control. At the heart of disease control is a good, well functioning diagnostic laboratory and network of field clinics. The Diagnostic Center at Tha Phra is operating much better than would be expected, but needs strengthening to become fully effective. Equally as important is the less than satisfactory network of veterinary clinics which should link the farmer with the diagnostic lab. In the present scheme the Diagnostic Center does not work side-by-side with the veterinary clinics.

Rapidity of response in the surveillance effort is absolutely essential to a disease control program, especially when "exotic" diseases are introduced. But, at present, the system is cumbersome with diagnostic laboratory people often having to carry out field work that should be done by field staff.

Objectives. Strengthen the 8 clinics in the Northeast.

Train farmers and technicians in disease control procedures

Develop and carry out the comprehensive disease control program made possible by Project #1.

Implementation. The first step will be improvement of seven field clinics plus the eighth at the Tha Phra Diagnostic Center in the Northeast by augmenting their extremely meager amount of equipment and supplies. Simultaneously, a training program for Kaset Tambon, LDC technicians, and livestock officers will be initiated. Beginning in the second year these technicians will be in a position to begin developing a series of farmer oriented extension programs with full recognition that the farmer is the most important link in development of a smoothly functioning system of disease diagnosis. The training program for RTG livestock technicians will be held as a one week workshop twice annually for the duration of the project.

Cooperating Agencies. The Division of Extension will play a major role in laying the educational groundwork in conjunction with the livestock officers in the Division of Veterinary Services. The officers will mobilize the veterinary clinic personnel, request that the Division of Disease Control send its ambulatory disease control unit to investigate or, alternatively/additionally, ask the Division of Veterinary Research to send Diagnostic Center personnel. The reverse of this sequence is also an option. The Division of Animal Nutrition may also be involved and, similarly, if vaccines are needed, the Division of Biologics is involved.

It is absolutely essential that all the above mentioned agencies work in concert. In the event of an "exotic" disease threat the sequence of events must be responsive and rapid.

Time Frame. The project will begin within the first 6 months and follow through for a period of 5 years.

Budget

Item	Y E A R					Total
	1	2	3	4	5	
(US\$1,000)						
Equipment and Materials						
Veterinary clinics. Renovation and strengthening of 4 in year 1 and 3 in year 2						
Renovation, \$5,000/unit	20	15	-	-	-	35
Vehicles, \$10,000/unit	40	35	-	-	-	75
Refrigerators, \$1,000/unit	4	3	-	-	-	7
Freezers, \$1,000/unit	4	3	-	-	-	7
Centrifuge \$2,000/unit	8	6	-	-	-	14
Typewriters, \$1,000/unit	4	3	-	-	-	7
Materials for agent workshops at \$10/agent x 500. livestock officers, LDC, and Kaset Tambons	5	5	5	5	5	25
Training						
Technical training for 500 technicians for 2 weeks annually						
12 days per diem	6	6	6	6	6	30
Travel at \$15/technician	7.5	7.5	7.5	7.5	7.5	37.5
Consulting						
Expatriates - 2 mm. for first 2 years at \$10,000/mm.	20	20	-	-	-	40
Thai--4 mm. for first 2 yrs. at \$1,000/mm. and 2 mm. thereafter	4	4	2	2	2	14
Total	122.5	107.5	20.5	20.5	20.5	291.5

Output. At the project's end the following can be expected:

Government will have generated support and confidence of farmers.

There will be a reduction in detrimental practices, such as farmer's eating dead or sick animals, due to a saturation advertising campaign.

A more smoothly functioning diagnostic procedure will be in place.

It is estimated that, for every dollar spent on the project, at least \$25-125 will be returned in recovered potential livestock losses.

A reduction of 20 percent may be expected in incidence of zoonotic diseases, i.e. those transmissible between animals and man. The danger from contacting brucellosis, anthrax, tuberculosis, leptospirosis, and rabies which directly threaten human life, will be reduced. This is an additional benefit apart from programs which conserve food stores of animal origin.

Conditions. DOLD should provide an adequate budget for vaccines and supplies not covered by the project. In addition, they should agree to fill all staff positions set forth at present. They should also agree to a training program to be coordinated through the Tha Phra headquarters. They should provide additional secretarial or technical assistance in the Division of Veterinary Service to handle paperwork so veterinarians and paravets can increase their field time.

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Most importantly, the veterinary clinics should work in close cooperation with the diagnostic laboratory, Division of Research. Ideally an actual reorganization to place the clinics under the Diagnostic Center would take place. But, failing that, a solid agreement between the 2 supervisors would also suffice. DOLD will also carry out a feasibility study on the reorganization of the animal health-related divisions to determine means of gaining more effective control and coordination.

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ANIMAL HEALTH

Project No. 3

Title. Improvement of Bovine Reproduction

Problem Statement. Reproduction rates in bovines in Thailand are too low for an efficient animal husbandry system. Reproduction is affected by a multitude of factors--nutrition, diseases, management, husbandry, sanitation, etc. Previous emphasis in Thailand has been placed upon the male rather than on the total problem, and the female in particular. A major constraint upon the routine examinations needed to improve reproduction rates is the training of both veterinarians and their assistants, the paravets, in skills needed to improve reproduction rates.

Objective. Provide training for LDC technicians, and paravets, in monitoring reproductive soundness in bovines.

Implementation. The project will aim at developing the skills of LDC technicians who, along with paravets currently assigned to provincial and district livestock officers, will work on an integrated program of AI and routine infertility work. These technicians will be trained in palpation procedures and taught the basic use of drug therapy.

This project will be coordinated by the Tha Phra headquarters. They will contract for services of expatriates who, along with Thai veterinary and animal science consultants, will develop 21 days of workshops annually, with sequences to be arranged. These are anticipated to include the equivalent of about one week of formal classroom lectures and two weeks of field work.

Cooperating Agencies. LDCs, LDIs, Division of Disease Control of DOLD and Livestock officers.

Time Frame. This project will begin within the first 9 months and will continue for 5 years.

Budget

I t e m	Y E A R					Total
	1	2	3	4	5	
	(US\$1,000)					
Materials and equipment						
Motorcycles at \$3,000 ea.	15	30	15	-	-	60
Gasoline, parts, etc.	2	6	8	8	8	32
Materials for agent workshops at \$10/agent x 300 agents	3	3	3	3	3	15
Training						
Technical training for LDC, LDU, vets & paravets; per diem for 400 people, 6 days/yr. at \$10/day	24	24	24	24	24	120
Travel expenses for 400 people, one workshop per year at \$15/person	6	6	6	6	6	30
Consultants						
Expatriates 4 mm annually for 3 years at \$10,000/mm	40	40	40	-	-	120
Thai 6 mm at \$1,000/mm	<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>	<u>30</u>
Total	96	115	102	47	47	407

- Expected Output.
1. Reduce the calving interval by 1 month for animals reached by the project.
 2. Develop a smoothly functioning system of animal care to the extent that farmers have confidence in, and support, the program.

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3. Develop a program of preventive medicine which focuses on the cow, heretofore forgotten.
4. Improve communication to the extent that provincial and district veterinarians, LDCs, farmers and diagnostic lab personnel interact in a coordinated manner on disease prevention and control.
5. Develop an understanding that animal health is largely a management problem and not just one of vaccination and disease identification post facto.

Conditions. There must be complete agreement that the concept of using LDC personnel for paravet training is accepted and supported.

COST SUMMARY

A summary of base (1982 constant dollars) project costs is provided in Table 7.1. Total costs are \$6.2 million, of which \$2.8 million is allocated to the first year. About 30 percent of all costs are for institutional support and another 30 percent for breeding projects. About 20 percent is designated for animal health, with the remainder allocated to nutrition projects and the NBRDC. The total costs with a 5 percent contingency and 10 percent inflation factor is \$9.0 million, as shown at the bottom of the Table.

Table 7.1. Summary of project costs by sub-project

I t e m	Project Year					Total
	1	2	3	4	5	
	(September, 1982 US. dollars)					
<u>Institutional Support</u>						
1. Continuation of the N.E. Livestock Development Project	455.0	282.5	352.5	732.5	232.5	1,545.0
2. Support for National Buffalo Research & Development Center (NBRDC)	80.0	85.0	90.0	95.0	100.0	450.0
<u>Breeding</u>						
1. Expansion of Improved Crossbred Bovine Breeding Stock via Performance Testing	456.0	-	-	-	-	456.0
2. Performance Testing and Management Training for Cattle in Villages	562.0	-	-	-	-	562.0
3. Improving the Crossbreeding of Buffalo & Cattle through Artificial Insemination	250.0	70.0	70.0	70.0	70.0	530.0
4. Expansion of Improved Native Thai Breeding Stock via Performance Testing	508.0	59.0	59.0	59.0	59.0	754.0

Table 7.1 (cont.)

I t e m	Project Year					Total
	1	2	3	4	5	
<u>Nutrition</u>						
1. Improving Village Level Forage Production	120.0	60.0	-	-	-	180.0
2. Mineral Studies on Bovine Animals	55.0	35.0	35.0	35.0	35.0	195.0
3. Studies on Growing/Finishing Bovine Animals on Grass	30.0	30.0	30.0	30.0	30.0	150.0
4. Finishing Bovine Animals on Rations Containing Agricultural By-products and Local Feeds	-	50.0	50.0	40.0	-	140.0
5. Improving Agricultural By-products and Wastes for Use in Bovine Feeding	20.0	20.0	25.0	20.0	20.0	105.0
<u>Health</u>						
1. Improvement of Animal Disease Control and Surveillance and Subsequent Disease Survey	209.0	194.6	154.4	-	-	558.0
2. Control of Infectious Diseases of Food, Fiber and Draft Animals in Northeast	122.5	107.5	20.5	20.5	20.5	291.5
3. Improvement of Bovine Reproduction	<u>96.0</u>	<u>115.0</u>	<u>102.0</u>	<u>47.0</u>	<u>47.0</u>	<u>407.0</u>
Total	2,973.5	1,108.6	988.4	649.0	604.0	6,323.5
<hr/>						
	Calendar Year					Total
	1984	1985	1986	1987	1988	
Sub-total with contingencies (5%)	3,111.7	1,164.0	1,037.8	681.5	634.2	6,629.2
Inflation (10% with 1982 as a base)	3,765.2	1,548.1	1,515.2	1,097.2	1,122.5	9,048.2

The cost estimates (in constant 1982 dollars) have been rearranged in Table 7.2 according to type of input. About 17 percent is for consultants, 5 percent for vehicles, 40 percent for commodities, 19 percent for participant training, and 24 percent for other items, most of which is working capital for the station and village level testing, multiplication, and nutrition programs.

Table 7.2 Summary of project cost by type of input

Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (%)
	1	2	1	2	3	4	1	2	3	4	5	1	2	3		
(US\$1,000)																
Year 1																
Assistance																
Director	100	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Senior consultant	90	20	-	-	-	-	20	20	-	-	10	-	20	40	220	-
Consultants	24	-	-	-	-	-	-	-	-	-	-	-	4	6	34	-
	45	12	-	-	-	-	-	-	-	-	-	45	40	15	158	-
Purchase																
Equipment	8	2	60	40	50	508	-	35	30	-	10	14	29	5	791	-
Supplies	65	10	-	-	200	-	-	-	-	-	-	68	16	-	359	-
Training																
Graduates	-	-	-	-	-	-	-	-	-	-	-	60	-	-	60	-
Staff & others	73	-	-	-	-	-	-	-	-	-	-	21	13	30	137	-
Working capital	50	36	296	522	-	-	100	-	-	-	-	-	-	-	1004	-
	455	80	356	562	250	508	120	55	30	0	20	209	122	96	2,863	-

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Table 7.2. Summary of project costs by type of input (cont.)

Type of Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (?)
	1	2	1	2	3	4	1	2	3	4	5	1	2	3		
----- (US\$1,000) -----																
<u>Year 2</u>																
Technical assistance																
Co-manager	100	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Expatriate consultants	40	-	-	-	-	-	10	-	-	-	10	-	20	40	120	-
Local consultants	24	-	-	-	-	-	-	-	-	-	-	-	4	5	34	-
Vehicles	-	18	-	-	-	-	-	-	-	-	-	32	35	30	115	-
Commodities																
Local purchase	8	3	-	-	70	59	-	35	30	-	10	13	23	39	260	-
Foreign	7	10	-	-	-	-	-	-	-	-	-	68	12	-	97	-
Participant training																
Advance degree	-	-	-	-	-	-	-	-	-	-	-	33	-	-	33	-
Workshop & others	54	4	-	-	-	-	-	-	-	-	-	22	13	30	123	-
Other, including working capital	<u>50</u>	<u>45</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>50</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>145</u>	-
Total	283	80	0	0	79	59	60	35	30	0	20	168	107	115	1,027	-

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7.2. Summary of project costs by type of input (cont.)

Type of Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (%)
	1	2	1	2	3	4	1	2	3	4	5	1	2	3		
(US\$1,000)																
<u>Year 3</u>																
Technical assistance																
Manager	100	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Tripartite consultants	40	-	-	-	-	-	-	-	-	10	10	-	-	40	100	-
Local consultants	24	-	-	-	-	-	-	-	-	-	-	-	2	6	32	-
Services	-	2	-	-	-	-	-	-	-	-	-	26	-	15	43	-
Equipments																
Equipment purchase	8	4	-	-	70	59	-	35	30	40	15	34	5	11	311	-
Signage	7	10	-	-	-	-	-	-	-	-	-	34	-	-	51	-
Participant training																
Diploma degree	70	-	-	-	-	-	-	-	-	-	-	60	-	-	130	-
Shop & others	54	-	-	-	-	-	-	-	-	-	-	-	13	30	97	-
including working capital	<u>50</u>	<u>64</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>114</u>	-
	353	80	0	0	70	59	0	35	30	50	25	154	20	102	978	-

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Table 7.2. Summary of project costs by type of input (cont.)

Type of Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (%)
	1	2	1	2	3	4	1	2	3	4	5	1	2	3		
(US\$1,000)																
<u>Year 4</u>																
Technical assistance																
Co-manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Expatriate consultants	40	20	-	-	-	-	-	-	-	10	10	-	-	-	80	
Local consultants	24	-	-	-	-	-	-	-	-	-	-	-	2	6	32	
Articles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Commodities																
Local purchases	8	5	-	-	70	59	-	35	30	40	10	-	5	11	273	
Foreign	7	10	-	-	-	-	-	-	-	-	-	-	-	-	17	
Participant training																
Advance degree	50	-	-	-	-	-	-	-	-	-	-	-	-	-	50	
Workshop & others	54	-	-	-	-	-	-	-	-	-	-	-	13	30	97	
Other, including working capital	<u>50</u>	<u>60</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>110</u>	
Total	233	95	0	0	70	59	0	35	30	50	20	0	20	47	659	

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Table 7.2. Summary of project costs by type of input (cont.)

Type of Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (%)
	1	2	1	2	3	4	1	2	3	4	5	1	2	3		
----- (US\$1,000) -----																
<u>Year 5</u>																
Technical assistance																
Co-manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Expatriate consultants	40	-	-	-	-	-	-	-	-	-	10	-	-	-	50	
Local consultants	24	-	-	-	-	-	-	-	-	-	-	-	2	5	32	
Trucks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Commodities																
Local purchase	8	5	-	-	70	59	-	35	30	40	10	-	5	11	273	
Foreign	7	20	-	-	-	-	-	-	-	-	-	-	-	-	27	
Participant training																
Advance degree	40	-	-	-	-	-	-	-	-	-	-	-	-	-	40	
Workshop & others	54	5	-	-	-	-	-	-	-	-	-	-	13	30	102	
Other, including working capital	50	70	-	-	-	-	-	-	-	-	-	-	-	-	120	
Total	223	100	0	0	70	59	0	35	30	40	20	0	20	47	644	

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Table 7.2. Summary of project costs by type of input (cont.)

Type of Input	Institutional support		Breeding				Nutrition					Health			Total	Distribution (%)																																																																																																																																																																																																															
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Economic Analysis

Ideally, project analysis should have a financial analysis, to reflect the client's viewpoint, and an economic analysis which would reflect societies' viewpoint. Pre-project costs and returns for typical farmers are calculated first and the post-project costs and returns are then estimated. The net incremental benefits (cash flow) are then discounted back to the present using various discount factors until the factor is found at which the net present worth is zero. This discount factor is the internal rate of return. Rates for farmers should be at least equal to their opportunity cost of capital and, in the economic analysis, at least equal to the social discount rate.

Calculation of costs and benefits from the farmers' viewpoint in this livestock project is extremely difficult and requires numerous tenuous assumptions, as very few purchased inputs are used. In addition, the rates of return are extremely high because the economic base is quite low. Thus, many of the numbers which would be generated are virtually meaningless. Another problem is that of estimating the number of beneficiaries as there are no guidelines for estimating the diffusion of technology. Finally, because the activities are not directly revenue producing since the animals affected, mainly cattle and huffalo, are part of a cropping system, standard project analysis techniques are not appropriate.

A number of the projects are of an applied research nature. Although not directly comparable, studies on benefits from research projects in other countries indicate that the annual rate of return varies from 20 up to 96 percent. In general, the rates are 35-75 percent (Arndt and Ruttan, 1977).

The design team has attempted to develop the most cost effective ways for carrying out the livestock project. For example, the farming systems research and extension methodology has been employed wherever feasible to maximize the use of research funds and to provide field training for

researchers and extension personnel. Also, strategy criteria included use and reinforcement of existing institutions rather than creation of new ones. In addition, each activity was designed to stimulate additional private sector involvement to the extent possible. In other words, one measure of the project's success would be private farmers raising performance tested animals for sale so the livestock stations could concentrate to a greater extent on research; farmers fattening cattle; private auctions or sale yards displacing government facilities.

Project Justification and Issues

The most striking aspects of the Northeastern livestock industry are (1) the industry as well as agriculture and the Northeast as a whole are in a major transition period and (2) the institutional base is in place, but is not being used in anything approaching an optimal manner. The main justification for the project is that making better use of what has been a very expensive institutional structure to organize and build, will yield a very high cost-benefit ratio. In effect, even though donor agencies are fond of constructing buildings or other infrastructure, the real benefits, (and hardest part to carry out) are from modifying and "fine-tuning" previous efforts.

The project's target at the end of 5 years is to have moved the DOLD's Northeast regional activities more into a regulatory mode which is combined with an effective on-farm research and extension program. Another goal is to shift the stations from simply being producers of improved animals, to their ultimate role as applied research and extension centers. This shift will not, and cannot, come about quickly as middle level bureaucracy attitudes are slow to change.

Government policy continue to be a major deterrent to many potential livestock activities. For example, little attention has been given in this report to improving marketing except for promotion of sale yard facilities,

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because of the effective ban on development of private slaughterhouses. No subproject in the dairy subsector has been proposed except for a relatively small program on growing dairy crossbred heifers because farmers and processors of fresh fluid milk cannot compete with imported powdered milk. Only very minimal progress will be made in a national dairy industry until a tax is levied on imports of powdered milk to the extent that recombined milk is the same price as local milk. No activities have been prepared in vaccine production because it is believed that the private sector should be encouraged to carry out this function, with their work moving more toward a regulatory and disease control nature.

The proposed livestock project is quite small in terms of reaching the potential beneficiary. Nevertheless, the project's scope has been deliberately limited because the DOLD probably does not have the absorptive capacity to handle a much larger project. Training, for example, is limited to about 4-6 weeks per year per technician because of their field duties. Furthermore, it has been the team's philosophy that growth of Government staff and physical facilities should be restricted to the extent possible.

Considerable discussion has taken place about charging for AI, veterinary and vaccination services. It has been assumed in this project that the typical potential beneficiary cannot, or at least will not, pay for these type services, and that it is Government's duty to provide them. It is urged that a type of on-farm research testing program be conducted to determine the extent to which the service should be provided free and, additionally, the extent to which all types of basic government livestock services are needed and desired.

Overall, the basic approach in the project, and its rationale, is that a missing-link exists both between Government service organizations, and between research, extension and the farmer. An expanded discussion about a combined animal husbandry program is given in Appendix 7.5. The target effort is thus in assuring that researchers go to the field, and that extension specialists have a program to provide their clients.

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Appendix 2.1. Livestock Development Assistance: An International Perspective

Several institutions have recently examined the historical experience of livestock development projects in various regions of the world. At the risk of oversimplification, these evaluations have generally concluded that livestock projects have tended to perform poorly in terms of:

- a. Actual performance relative to planned performance;
- b. Technical improvements and changes in managements practices, and
- c. Economic and financial returns on capital invested.

Much of the problem has been attributed to poor management at the government level, project level, farm/ranch level, and individual animal level. Part of the failure to meet expected output criteria is due to lack of experience with managing livestock projects, part due to problems of applying improved production practices without the support for research and extension services, and part due to incompatibility of the development project with existing social structures.

The livestock development projects sponsored by international donors/lenders have supported institutions, livestock production in extensive production systems, and livestock production in mixed farming systems. Most projects are formulated on the basis that the low productivity of the traditional livestock production systems can be quickly improved by applying modern principles of ranch management, intensive feeding, and market infrastructure improvements. The feasibility studies, however, seldom go into the necessary detail on the constraints which

Appendix 2.1 (cont. p. 2)

interact to give rise to the seemingly low levels of observed offtake. In addition, projects focusing on mixed crop-livestock systems seldom take account of the complexities of these systems and the slow improvements that result from marginal changes in one component of the system. In particular, the interrelated constraints on livestock productivity (health, nutrition, reproduction, genetic potential, management) tend to require simultaneous solution to achieve big gains in productivity since improvements in one constraint tend not to be felt since other constraints continue to be limiting.

The proposed livestock component of RAI can manage to avoid many of the problems associated with other livestock projects by AID and the RTG, by recognizing that improvement of large animal production is a slow process because of the biological constraints on reproduction, and that most benefits from the project will be long-term in nature. Second, the team has taken the approach that project planning for the mixed farming systems of Northeast Thailand must proceed from the farm level upwards and must take careful account of the results obtained by previous livestock projects in the Northeast. Third, the project is fortunate in that a good basic infrastructure has been put in place through efforts of the RTG, and previous projects. Therefore, the RAI-livestock component can provide additional strategic resources as needed to obtain maximum benefit from existing institutions. The institutional structure to be used is essentially in place and the focus will be on generating technology for farmers; and testing, refining and evaluating it in conjunction with farmers themselves. The study mission has concentrated on institutional and farm level constraints and has designed specific projects that focus clearly on these constraints. Each project is also designed to focus on specific production systems and specific market opportunities.

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Appendix 4.1. Village Case Studies # 1 and 2

I. Ban Huey Wa, 35 km east of Khon Kaen city.

II. Ban Thon, 20 km north of Khon Kaen.

Cattle and buffalo husbandry in these villages was studied in 1969-70 by one of the consultants* who, during the present mission, returned briefly to the sites to form impressions of changes that have occurred in the last 12 years. Village leaders provided their estimates which appear below, along with earlier survey data.

	<u>B H W</u>		<u>B T</u>	
	<u>1970</u>	<u>1982</u>	<u>1970</u>	<u>1982</u>
No. of Households	190	250	190	300
Cattle	200	75	275	200
Buffalo	390	450	380	75
Ducks	few	few	few	3,000
Carts	many	few	few	none
Tractors, 2 wheel	-	-	1	10

Both villages were relatively large in 1970, but they have since expanded to become very large. The increased population came about largely through division of holdings to support offspring. Ban Thon will soon be split into 2 villages for easier administration.

*Rufener, W.H. 1971. Cattle and Water Buffalo Production in Villages of Northeast Thailand. Ph.D. thesis submitted to University of Illinois, Urbana.

Appendix 4.1 (cont. p. 2)

In 1970, farmers in Ban Huey Wa had already upgraded many of their cattle with Brahman bulls and there was great interest in cattle production, both for sale and for pulling carts. Now the numbers of cattle there have dropped sharply, despite an apparent 5-fold increase in average price for cattle. The main reason given was that the village has had about 4 consecutive years of drought, and cattle had to be sold for cash to buy rice. Also there is less need for carts now, and they said it is more difficult to find feed for cattle, although there is still some 1,500 rai of communal land.

The population of buffalo in Ban Huey Wa has increased slightly, probably to meet the draft needs of the additional families. In 1970 the farmers paid no particular interest to breeding their buffalo cows; no one could identify the sire of their calves. Buffalo still seem to be managed the same as in 1970, but now the farmers are concerned that they don't have an identifiable sire. There is a privately owned Murrah-crossbred bull in the village, but no one except the owner uses it because of its strange appearance.

In Ban Thon, most of the upper paddy fields have been planted to cassava and sugarcane, leaving very little area for the traditional pattern of bovine grazing management. And, with irrigation water available from the Nong Wai Project, two wheel tractors have increased in number because they have an advantage over buffalo in the speed and amount of work they can do. For these reasons, buffalo numbers have dropped dramatically and cattle numbers have decreased slightly. Cattle in Ban Thon were formerly managed in cow-calf units, and this apparently has not changed.

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Appendix 4.1 (cont. p. 3)

Both villages have benefitted from several RTG infrastructure projects: better roads, rural electricity, and public health programs. Neither village was within areas served by the DOLD's extension work under the World Bank project, but there reportedly was some improvement in delivery and utilization of services nonetheless. Thievery of cattle and buffalo is reportedly much less of a problem than formerly.

In Ban Thon there was heard some disaffection with the trend of farm development. The retired Kamnan (who bought the first tractor in the village) said that many farmers are "crazy about tractors" right now, but he expected bovines to come back in importance when more farmers realize the disadvantages of tractors. A second farmer, who previously owned more than 20 head of cattle, doubted the wisdom of their new dependence on cassava and sugarcane. Now they can't sell the cane and the cassava price is much lower than a few years ago, while bovine prices have trended steadily upward but they don't have land left for traditional grazing.

Continuing interest in breed improvement was expressed in both villages. For example in Ban Thon, at least one cattle owner routinely travels more than 30 km to Tha Phra to ask for AI service when his cows come in heat.

There were many new houses in both villages and no outward signs of absolute poverty in drought-stricken Ban Huey Wa.

Animal handling facilities built in both villages in 1969 were still largely intact and could be used again for bovine research and improvement.

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Appendix 4.2. Village Case Study #3

Non Som Boon Village, 7 km south of Tha Phra, Khon Kaen Province.

This village was a case study village of one of the consultants during 1970-71. This note provides an update about developments in that village over the ensuing 11 years, and examines predictions made during the earlier study about the structure of cattle and water buffalo production.

Major Changes Observed

It should be noted that this village is not typical of most Northeastern Thai villages as it has access to good transportation, was an early recipient of Brahman cattle from the Tha Phra livestock station, and is within easy daily commuting distance of Khon Kaen. Despite these atypical circumstances, the village in 1970-71 was traditional in that it was heavily based on glutinous rice as a staple crop, kenaf as a cash crop, and water buffalo for field cultivation.

The tremendous changes which occurred in the village during the past 11 years once more reinforce the team's impression about the dynamism of Thai agriculture.

First, the village families have expanded from 52 in 1970/71, to 133 households in 1982 of which 103 are still farmers. The other 30 non-farming households derive their income from a neighboring cement plant. Earlier, all farmers produced rice, but now only about three-fourths cultivate that crop. Kenaf cultivation, which has virtually disappeared, has been replaced by cassava, sugarcane and tomatoes, the latter grown on contract for a local processing factory. Rice is commonly purchased. Many farmers have new houses with screens, private wells, and almost all have electricity. None of this was evident earlier.

Appendix 4.2 (cont. p. 2)

The number of buffalo has declined dramatically as predicted in the earlier study but the number of cattle owners and cattle numbers has remained static, whereas the earlier study predicted that the relatively high rates of return to Brahman cow-calf operations would lead to a steady expansion. The reason lies with the changes in land use patterns. Earlier, all land was free for grazing during the dry season but now wet season rice land is followed by dry season, pump-irrigated tomatoes. Kenaf land has been converted to cassava and sugarcane, crops which occupy the land continuously. In addition, the availability of the dual-purpose agricultural vehicles called "iron-buffalo", (2-wheel tractors), and hired large 4-wheel tractors from Tha Phra has decreased the need for all kinds of draft animals.

The prices for custom plowing have increased only 200-250 percent while animal prices have shown the following trends:

<u>Category</u>	<u>Average Price (Baht)</u>		
	<u>1970/71*</u>	<u>1982</u>	<u>Increase</u>
	<u>Baht</u>	<u>Baht</u>	<u>Percent</u>
<u>Water buffalo</u>			
Young male replacements	1,600	10,000	625
Young female replacements	1,170	8,000	683
Cull males	1,890	6,000	317
Cull females	1,440	6,000	417
<u>Brahman crossbred cattle</u>			
Young male replacements (breeder)	1,940	18,000	928
Young female replacements	1,740	9,000	517
Cull males	1,200	5,000	417
Cull females	1,410	5,000	355

*Source: De Boer, A.J. and D. E. Welsch. 1977. Constraints on cattle and water buffalo production in a northeastern Thai village. In R.D. Stevens (ed.), Tradition and Dynamics in Small-Farm Agriculture: Economic Studies in Asia, Africa and Latin America. (Ames: Iowa State University Press), pp. 115-141.

Appendix 4.2 (cont. p. 3)

Despite cattle and buffalo price increases far in excess of the inter-period inflation, the constraints on feed supply, and rapid expansion of profitable cash crops, there has been a substantial decline in total animal units in Non Som Roon. The analysis indicates the difficulties inherent in projecting trends in a dynamic agricultural setting. It may be concluded that, in terms of selecting villages or broader client groups for project participation, managers should concentrate on areas where large components of traditional rice/upland crops/livestock production can be expected to remain in place for long periods of time. Otherwise, the potential impact of component technologies applied to livestock production will be overwhelmed by external effects such as off-farm employment, irrigation development, major changes in cash crop production or major shifts in land cultivation practices.

Appendix 4.3. Village Case Study #4

Ban Dong Phong, less than 15 km from Khon Kaen.

This village was studied from an anthropological perspective by Dr. Leedom Lefferts about 10 years ago, and again in recent months. His observations are reported second hand here for useful insight to social change in the Northeast. The village's land is mostly irrigated rather than rainfed.

Ban Dong Phong has grown from 104 households up to 140. Average household size is smaller than before. It is normal now for wives to have tubal ligation done when they have 2 or 3 children, at the age of about 22. Children are normally spaced 2 years apart. There seems to be many more aged and invalid people in the village now.

Only about 5 households use water buffalo; everyone else uses 2-wheel tractors. Available labor is a real constraint on bovine husbandry.

The normal rate for hiring tractor work, with the owner operating it, is 200 Baht/rai. But tractors tend to be used within extended families, so members can get work done for only the cost of fuel. Opportunity cost is the main determinant in deciding whether or not to use tractors.

The full package of machinery is present in the village: a tractor, a small truck, a thresher, and a water pump, all using the same interchangeable diesel engine. After straw goes through the thresher, it is heat up and can't be stacked and kept in the usual manner; villagers consider that straw to be worthless so they burn it.

Appendix 4.3 (cont. p. 2)

Some 10 households each raise about 2,000 broilers per hatch on contract. They know they make less this way than if they were independent, but they prefer the security of a contract arrangement.

Duck-raising was important, and it's more important now in the village economy. The norm is for 140 birds to produce 100 eggs per day. There is even a duck egg hatchery and distribution system within the village. Hog raising has also expanded and developed, but appears to be only marginally profitable.

Lefferts also noticed changed sex roles. It is common now for women to till paddy and, with either a buffalo or tractor, and to broadcast seed in rice nursery beds. These jobs were formerly done only by men.

Appendix 4.4. Observations about improvement of animal health in the Northeast

Following are a number of general observations by team member Dr. Carson on improving animal health in the Northeast. They are described here to provide background and a further basis for understanding the "why" and "how" of the animal health problems so that all projects will be better understood.

1. Liaison with the field. Presently, the villager is not "programed" to detect disease early and contact the nearest government official. The farmer often waits until an animal dies, opens the carcass as a source of food, and may contact animal health officials as an "after thought". By that time the tissues are often worthless for diagnostic purposes.

The present project would educate the headsman, owner or agent to contact the most accessible technical advisor (e.g. LDC, extension person, kaset tambon or livestock officer) about diseased live animals or dead animals before autolysis of tissues has occurred. This is extremely important in tropical climates where post mortem tissue changes and bacterial invasion of parenteral tissues proceeds most rapidly. Disease awareness, diseases transmissible between man and animal (e.g. by eating antrax contaminated meat) and early reporting may be topics best presented to the villager. Additionally, to maintain interest, diligence and dedication, additional programs or fellowships might be made available for government personnel.

2. Field personnel dispatch. There is no standard sequence of events that engages immediate assistance when a call for assistance is received. Mobile units should be dispatched promptly to investigate and examine live animals or collect sample for the Diagnostic Laboratory.

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Appendix 4.4 (cont. p. 2)

3. Diagnostic Laboratory. Samples which arrive at the laboratory in Tha Phra often take excessively long periods for simple histopathology due to the presence of only one autotechnician a single trained technician to process samples and few professionals to "read" slides. Technicians in place at Tha Phra should receive short term training grants which would allow them to make test antigen, other test reagents, and freshen their knowledge of sterile techniques, new procedures and tissue culture. Graduate training fellowships should be developed in each of the subsections; pathology, bacteriology, immunology, serology, public health, and parasitology. Finances should also be provided for more reagents, disposable supplies and provided that a preliminary diagnosis can be made the local livestock officer (who in turn will contact owner) should be notified in advance of confirmatory tests. Final results will hopefully reach field personnel while the disease problem is still "fresh" in the minds of the veterinarians and the farmer.

4. Cooperative Agencies. Present interdivisional relationships in the DOLD are confusing and redundant. There is no clear sequence of events that engage first one "unit" and then another. In the proposed scheme, the DOLD's Division of Extension, LDC or kaset tambon (of the Department of Agricultural Extension), serving as the villager's direct contact, should relay information through the District Livestock Officers of the Division of Veterinary Services to the Diagnostic Laboratory in the Division of Research. The latter agency should then coordinate their services with mobile units of the Division of Disease Control and the Veterinary Clinic (Division of Veterinary Services). Extension personnel will play an important role in educating villagers.

The project components will complement and cooperate with the NERAD team and other programs such as those of the World Bank field units, LDC and LDU, and the German government's program to strengthen the Diagnostic Laboratory at Tha Phra. This cooperation will be described in Project 2.

Appendix 4.4 (cont. p. 3)

5. Necessary Resource Reinforcement. In the operational "chain of command" the Livestock Officers (at Amphoe and Changwat level) should play an integral role in deciding which regulatory or disease control units are to be assigned to particular cases. However, these people are apparently so burdened with administrative paperwork that they seldom have the chance to engage in day-to-day veterinary medicine. In this regard it would be advantageous to have 2 or 3 times the present staff. At present there are 16 provincial Livestock Officers in the Northeast and all are not graduate veterinarians. At the Amphoe level these positions may also be held by professionals and non-veterinarians. Increasing the number of Livestock Officers would be helpful, but is not realistic since the DOLD is not hiring additional staff. The only other alternative is to try to relieve the officer as much paperwork as possible by delegating this activity to administrative assistants or paraveterinarians. Another "bottleneck" is that adequate numbers of vehicles and/or motorcycles are not available to respond to field call quickly.

The Diagnostic Laboratory should have a full complement of these and adequate senior staff members in gross and histopathology, virology, pathogenic bacteriology, serology and parasitology. At present it appears that doubling the staff with a balance of professionals and technicians would be adequate, but again this is not realistic. Specifically there are no experienced people in serology or virology. Parasitology is also "thin" having only 1 junior staff person. Pathology can process very few samples per day having only 1 technician and 1 autotechnician. The animal health mobile units, used to collect and preserve samples and establish initial treatment, should have the necessary personnel with means of transportation. Additional materials and equipment needed are disposable supplies, ultra low temperature freezers, reagents and test antigens for isolation and identification of infectious agents and carrying out serologic procedures. Antigens that can't be purchased or are very expensive can be prepared in the laboratory after the personnel have been specifically trained domestically or abroad for 3-6 months.

Appendix 4.4 (cont. p. 4)

Each of the seven Veterinary Clinics in the Northeast should be strengthened (see Project No. 2) and allied with the Diagnostic Laboratory for logistical reasons. An eighth clinic should also be outfitted within the physical confines of the Diagnostic Laboratory.

6. Time Frame. The Diagnostic Laboratory should be strengthened within the first 6 months off the project as prescribed above so that it can diagnose the full spectrum of common diseases. Analysis of the disease incidence and prevalence in the Northeast, with information on relative importance, should be accomplished in the first year. This process may be strengthened by short courses in the U.S. for on-the-job training of either professionals or technicians. Measures to rectify deficiencies and strengthen the entire area of diagnostic services should continue through the duration of the RAI program.

7. Expected Benefits. The entire animal health program depends on a rapid and accurate diagnostic network. Reporting, recognition and containment practices form the essence of any program designed to limit production constraints related to disease. Under existing conditions and the laboratory efficiency in diagnoses (assuming that field samples are not autolyzed) the chance of arriving at a correct and specific diagnosis is about 30 percent and of each sample received. With the recommended improvements the percentage may climb to 75 percent over a 2 year period.

8. Note. The Diagnostic Center at Tha Phra is an excellent facility with highly dedicated and motivated personnel but it lacks funds for test reagents and antigens, expendable supplies and additional equipment (see Budget). A moderate infusion of funding and assistance in training technicians and graduate students would rapidly pay dividends.

Appendix 4.4 (cont. p. 5)

9. Thai/German Animal Health Project. This project, located in the Veterinary Diagnostic Center at Tha Phra, is being considered for renewal after its first 5 years. Its purpose has been to "integrate the relatively new veterinary Diagnostic Services into the traditional Veterinary Field Services by diagnosis, investigation and advice on disease control programs. Through this project it was planned that a differential diagnosis could be obtained in more submissions thus clarifying disease prevalence and incidence.

Since the largest percentage of field samples are still unusable due to post mortem changes and the laboratory is virtually incapable of serology and virology, the actual disease "picture" does not seem to have yet been successfully defined. The regulatory and veterinary services to the farmer are not a smooth sequence of events from recognition to reporting, and diagnosis to treatment. The problem areas seemingly causing inertia are identified in a recent report by the German scientists.

For a number of reasons, the German project has not been as effective as hoped. For one major reason concerns a failure to recruit all personnel, German professional and technical, for full use of the equipment purchased. This USAID project would complement the German project in that it would provide the equipment necessary to make this a "full-service" laboratory and then provide a budget for the training of Thai technicians for operating the equipment, German or U.S. It is also anticipated that the German technicians now present in the laboratory would be used to train Thai technicians in the use of the newer U.S. equipment.

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10. Lampang Northern Regional Diagnostic Center. The building is well kept and the leadership is enthusiastic and sincere. The staff is bright and ready to begin to provide every necessary service related to regulatory and individual animal diseases. However, this lab does need additional financial support, such as the Central Laboratory in Bangkok has from the RTG, the Northeast has from the German government and the Southern Region has from the Japanese. It is suggested that USAID might consider assistance to their lab, with the justification being that the lab is the front line of defense in keeping the Northeast free of exotic diseases moving in from Burma or Laos through the Northern area of Thailand. Presently, the Northern laboratory lacks equipment, supplies and trained personnel for rapid and accurate diagnosis of field cases. Its capabilities are very limited and at this point it is strongly doubted whether the laboratory would detect exotic diseases before they had moved into the Central or Northeast regions. In a word to northern region is vulnerable. Step must be taken by the RTG quickly to reinforce it.

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Appendix 5.1. Institutions of the Royal Thai Government, their relation to Livestock Development in the Northeast

Institution	Major Functions	Physical Facilities	Remarks
Department of Agricultural Extension	Crop agriculture	Regional Agricultural Extension Office located at Tha Phra across from NEROAC	National plan is to have one extension person in each agricultural Tambon. At present the agents only deal with crops. Plan is to have agents eventually act as a coordinator for all aspects of crop and animal agriculture and to use subject matter specialists. Have formed "farmer groups" which have been relatively successful.
Department of Agriculture (DOA)	Crop agriculture	Have 30 stations in the Northeast. No regional coordinating office	Now setting up a farming systems institute (at division level) which will include animal agriculture as it is integrated in cropping systems. The Department does research work in some major crops such as rice and will have, to a greater extent, a relationship to animal agriculture.
Department of Land Development (DLD)	Soil Conservation	Have 7 centers in the Northeast	Main emphasis is soil conservation and, as such, working with cover crops.
Royal Forest Department (RFD)	Conservation of forest reserves and reforestation	Have 22 offices and stations in the Northeast	Control large grazing areas. Hamata seed was sown extensively in coordination with them as part of the World Bank Project.

Institution	Major Functions	Physical Facilities	Remarks
Cooperative Promotion Department (CPD)	Promotion of Cooperatives		<p>Have developed pig and dairy raising raising cooperatives. Have achieved a certain degree of success in credit cooperatives, but virtually no success in marketing cooperatives. Can play a major role in training farmers via their cooperatives. National plan calls for extended agricultural cooperatives largely because farmers buy few inputs, sell few products, and the coops have been organized on a "top down" approach. A recent survey shows that out of more than 500 coops established in the last 69 years, only 13 are now active.</p>
Regional Centers	Coordination	<p>Northeast Regional Center for Agriculture and Cooperatives (NEROAC), located at Tha Phra</p>	<p>NEROAC does livestock research on a very limited scale. The Center was built under the USAID project carried out by the University of Kentucky team. Office of Agricultural Economics, regional officer, regional livestock diagnostic lab, and Northeast Rainfed Agricultural Development Project (NERAD) also located at NEROAC.</p>

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Institution	Major Functions	Physical Facilities	Remarks
Department of Livestock Development (DOLD)	Livestock development and disease control	Northeast Offices are: (a) Regional Livestock Office (2) (b) Office of Livestock Development Project (1) (c) Veterinary service stations (12) (d) Livestock stations (6) (e) Forage crop stations (10) (f) Public grassland improvement Proj.(4) (g) Artificial insemination stations (5) (h) Provincial livestock development office (16)	Every one of the Northeast offices listed under "physical facilities" is at a separate location. The Provincial livestock development offices are located in the provincial governor's offices.
Regional livestock offices	Administrative and disease monitoring	Office in each of 9 regions. NE offices are at Korat and Udon	Limited staff with virtually no action responsibilities.
Provincial livestock offices	Administrative and disease monitoring	Located in Governor's office in each province	Will be given more active role in livestock extension.

Institution	Major Functions	Physical Facilities	Remarks
District livestock offices	Administrative, disease monitoring, and vaccinations	At district (Amphoe) office	
<u>DOLD Health - related Divisions</u>			
Division of Disease Control	Control of live animal movement, operate mobile vaccination units	Quarantine stations	
Division of Veterinary Service	Operate the district and provincial livestock development offices. Provide vaccination service in conjunction with Division of Disease Control.	Officers are located in district and provincial livestock offices. Have veterinary service stations (12 in the Northeast)	
Division of Veterinary Research	Disease investigations	Most of facilities are in Bangkok.	
Division of Veterinary Biological Products	Produce vaccines sera and antigens	Pak Chong Vaccine Stations and Bangkok	

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Institution	Major Functions	Physical Facilities	Remarks
<u>DOLD Production--related Divisions</u>			
Division of Animal Husbandry	Livestock Multiplication and Improvement	Livestock Stations: (a) Tha Phra (b) Maha Sarakham (c) Surin (d) Ubon (e) Sakhon Nakhon (f) Lamphyakhlang	
Division of Animal Nutrition	Forage Crop stations, public grassland improvement project	10 forage crop stations and 4 public grassland improvement projects	
Division of Artificial Insemination	Artificial breeding of livestock; semen production and processing	Artificial Insemination Stations: (a) Tha Phra (b) Nakhon Ratchasima (c) Si Sa Ket (d) Ubon Ratchathani (e) Nakhon Phanom	
Division of Feed Quality Control	Regulation of feed quality	Lab at Bangkok	
Division of Livestock Extension	Extension only on livestock		Created in 1981. Employees are located at the livestock stations.
Office of Livestock Development Project	Livestock development	16 livestock development units (LDUs) and 80 livestock development centers (LDCs). Head office at Tha Phra.	World Bank fund disbursement ended June 30, 1982. Apparently staff will continue their extension work, but under administrative control of provincial livestock officers.

Institution	Major Functions	Physical Facilities	Remarks
<u>Other National Government Offices</u>			
Office of Agricultural Economics (OAE)	Collection of data on inventory, cost of production, prices and analysis	Office in Bangkok, Regional office in Tha Phra at NEROAC.	Office of Agricultural Economics is on same administrative level as the other departments in the MOAC.
Department of Community Development	Rural Community Improvement	Development officer in each Tambon	Located in Ministry of Interior
Municipal Slaughter Houses	Animal slaughter	Slaughter houses at the larger metropolitan areas	Major regulatory body is Department of Local Administration in the Ministry of Interior. The chain of administration is down through the Provincial Governor and district officer and then the city mayor. The Phra Kanong Slaughter house in Bangkok has also been involved in live animal exports via their livestock holding facilities.
Preserved Food Organization (PFO)	Produce preserved food for the Armed Forces	Own one slaughter house and processing plant at Ban Pong (Ratchaburi Province)	The Preserved Food Organization (PFO) is owned by the Ministry of Defense. Most meat is processed for Armed Forces use. The PFO is also the only institution which exports cattle and buffalo beef. (Pork and poultry are exported by private companies).
Central Security Command	Provide livestock promotion activities in militarily sensitive areas	Farms for animal multiplication, feed production	In Ministry of Defense. In terms of numbers, personnel are about equivalent to one division in the DOLD. They collaborate with the DOLD.

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Institution	Major Functions	Physical Facilities	Remarks
Marketing Organization for Farmers (MOF)	Responsible for marketing of farmer products. Buy from farmers and resell	Own and rent storage facilities and a small terminal market in Bangkok	In MOAC. This is a state enterprise which is not civil service. The MOF is administratively at the level of a Department. Work mainly in crops. Very little in livestock.
Dairy Farming Promotion Organization of Thailand (DPO)	Promotion, buying and processing raw milk, provision of breeding stock, training	Dairy farm, breeding stock multiplication, processing plant and school at Muak Lek. Also have numerous milk collection centers.	Equivalent to a Department in MOAC. They were funded by the Thai-Danish Dairy Project. Now completely funded by a revolving fund and national budget. They also supervise "dairy colonies", i.e., groups of dairy farmers.
Ministry of Commerce; Internal Trade Department & Foreign Trade Department	Regulation of livestock prices and export permits	Office in Bangkok	They administer ceiling prices on all livestock commodities. Set at retail level, but ineffective!v enforced.
Kasetsart University	Teaching, research and extension	Main campus in Bangkok and a branch at Kampaengsaen	Kasetsart University is the major university in Agriculture. The university extension service is mainly for training of the trainers to farmers although there is some direct farmer training.
Khon Kaen University	Teaching, research and extension	One campus, at Khon Kaen	University was organized in 1964. They also do work with farmers like Kasetsart University does.
Vocational Agriculture Colleges	Teaching	There are numerous colleges in the Northeast	Offer 2 certificate levels after 3 or 5 years of training.
Bank for Agriculture & Agricultural Cooperatives	Credit	Offices in various towns	

Appendix 7.1. National Buffalo Research and Development Center (NBRDC)

Background

In December 1971 a technical committee of national and international experts chaired by the Director-General met to discuss livestock development policies in relation to the responsibilities of the Department of Livestock Development (DOLD). From this meeting a recommendation was made, among others, on urgent need to carry out research on the buffalo. It was emphasized that an interdisciplinary approach with inter-agency cooperation must be encouraged.

With two basic problems concerning buffalo production in mind, i.e. (1) the decrease of number of buffalo in Thailand, and 2) the reduction in mature body weight and size of buffalo, the DOLD decided to assign the Surin Livestock Station as the National Buffalo Breeding Center where various research activities related to buffalo production would be carried out in conjunction with a selection breeding program.

In August, 1975 a Memorandum of Agreement on buffalo research cooperation was signed by the DG of the DOLD, a representative of the Rockefeller Foundation, the Dean of the Faculty of Agriculture (KU), the Dean of the Faculty of Agriculture (KKU) and the Director of the Northeast Office of Agriculture. This Memorandum laid the cornerstone for the beginning of a mutual effort to improve buffalo production in order to upgrade the living of Thai farmers.

The project took slow paces at first while maintaining steady momentum. Meanwhile, the Faculty of Veterinary Science of Chulalongkorn University which has been keenly interested in buffalo research joined the project, as well as the Surin Agricultural College (Institute of Technology

Appendix 7.1 (cont. P. 2)

and Vocational Education) which is in the neighborhood of the Surin Livestock Station. The representatives from other institutes such as Chiang Mai University and Mae Jo Institute of Agricultural Technologies joined the project later on.

Agencies Involved

1. Department of Livestock Development (DOLD), Ministry of Agriculture and Cooperatives.
2. Kasetsart University (KU).
3. Chulalongkorn University (CU).
4. Khon Kaen University (KKU)
5. Chiang Mai University (CMU).
6. Surin Agricultural Campus (SAC), ITVE.
7. Chiang Mai Institute of Agricultural Technology (CMIAT).
8. Office of the Northeast Agriculture (ONIA).

Project Administration

The operation of the NBRDC is under the responsibility of the Administrative Committee, Project Director, and the Implementing Committee.

1. The Administrative Committee (Section V) is responsible for the formulation of the operation policy and budget for the NBRDC in order to achieve project's objectives.

Appendix 7.1 (cont. P. 3)

2. The Project Director is responsible for the operation of the NBRDC Office, planning of research and development, and training and farmer guidance programs with the approval of the Implementing Committee (see Organization Chart No. 1). That person also follows up on policy set forth by the Administrative Committee and promotes cooperation in research, development and extension among the collaborative agencies.
3. The Implementing Committee (Section V), comprised of personnel from collaborating agencies, and experts, regulates the research planning and development section and the training and farmer guidance section. They also specify research, development and research training plans, and promote extensive and efficient collaboration in order to achieve project's objectives.
4. The NBRDC Office is the center of cooperation among the collaborative agencies (Organization Chart No. 2) responsible for administration and business. The office is composed of an Administration and Business Section, Account and Supply Section, Records and Statistics Section, and Public Relations Section.

Operation

Owing to the fact that the operation of the NBRDC is based on cooperation between the DOLD and buffalo research units from different institutions, the operation of the Center thus focuses on the coordination of on-going activities of each institute, i.e.:

Appendix 7.1 (cont. P. 4)

1. Office of the National Buffalo Research and Development Center is responsible for coordination, procurement of facilities including experimental animals and budget to facilitate buffalo production research and development according to the Center's objective. Personnel of the Office are comprised of:
 - a. Office's Personnel
 - b. Personnel from each Institute
 - (1) International specialists.
 - (2) Researchers in each field carrying out research using budgets from fellowships, grants, etc.
 - (3) Temporary Employees - work as research assistants.
 - (4) Project Leader to provide leadership in each field.
2. Research Sites
 - a. DOLD's Livestock Breeding Stations will provide land area for research as needed. Experimental animals will be purchased by a revolving or working capital fund. Research facilities and equipment shall be acquired from different institutes and some procured by the main budget with approval of the Administrative Committee under the supervision of Project Director.
 - b. Laboratories in each institute shall collaborate in research according to its available equipment and the policy set forth by the Administrative Committee.

Appendix 7.1 (cont. P. 5)

Project Committees

Administrative Committee

1. Director-General, DOLD	Chairman
2. Director of Animal Husbandry Division, DOLD	Vice-Chairman
3. Director of Artificial Insemination Division, DOLD	Member
4. Director of Veterinary Research Division, DOLD	Member
5. Director of Animal Nutrition Division, DOLD	Member
6. Director of Livestock Development Project, DOLD	Member
7. International Buffalo Project Coordinator	Member
8. Director of the Office of the Northeast Agriculture	Member
9. Dean of Veterinary Faculty, CU	Member
10. Head, Department of Animal Science, KKU	Member
11. Head, Department of Animal Science, KU	Member
12. Head, Department of Animal Science, CMU	Member
13. Buffalo Project Coordinator, KU	Member
14. Buffalo Project Coordinator, KKU	Member
15. Buffalo Project Coordinator, CU	Member
16. Buffalo Project Coordinator, DOLD	Member
17. Rockefeller Foundation Representative	Advisor
18. NBRDC Director	Member & Secretary
19. Chief, Buffalo Section, Animal Husbandry Division, DOLD	Member & Assistant Secretary

Implementing Committee

1. NBRDC Director	Chairman
2. Director of Animal Husbandry Division, DOLD	Vice-Chairman
3. Buffalo Project Coordinator, DOLD	Member
4. Buffalo Project Coordinator, KII	Member
5. Buffalo Project Coordinator, KKU	Member
6. Buffalo Project Coordinator, SAC	Member
7. Buffalo Project Coordinator, CU	Member
8. Chief, Research Section, Livestock Development Project, DOLD	Member
9. Chief of Surin Livestock Breeding Station	Member
10. Chief of Lamphya Klang Livestock Breeding Station	Member
11. Chief of Nong Kwang Livestock Breeding Station	Member
12. Chief of Surat Thani Livestock Breeding Station	Member
13. Prominent Buffalo Research and Development Project Leaders	Member
14. Chief of Buffalo Section, Animal Husbandry Division, DOLD	Member & Secretary

Functions

1. Planning of buffalo research in compliance with the national development policies.
2. Developing guidelines for technology transfer for buffalo production and development
3. Specifying work plan, allocating budget, and approving research funds.
4. Planning of training program and farmer guidance concerning buffalo production and marketing according to developed technology.
5. Other duties in assisting and implementing research and development.

Chart No. 1

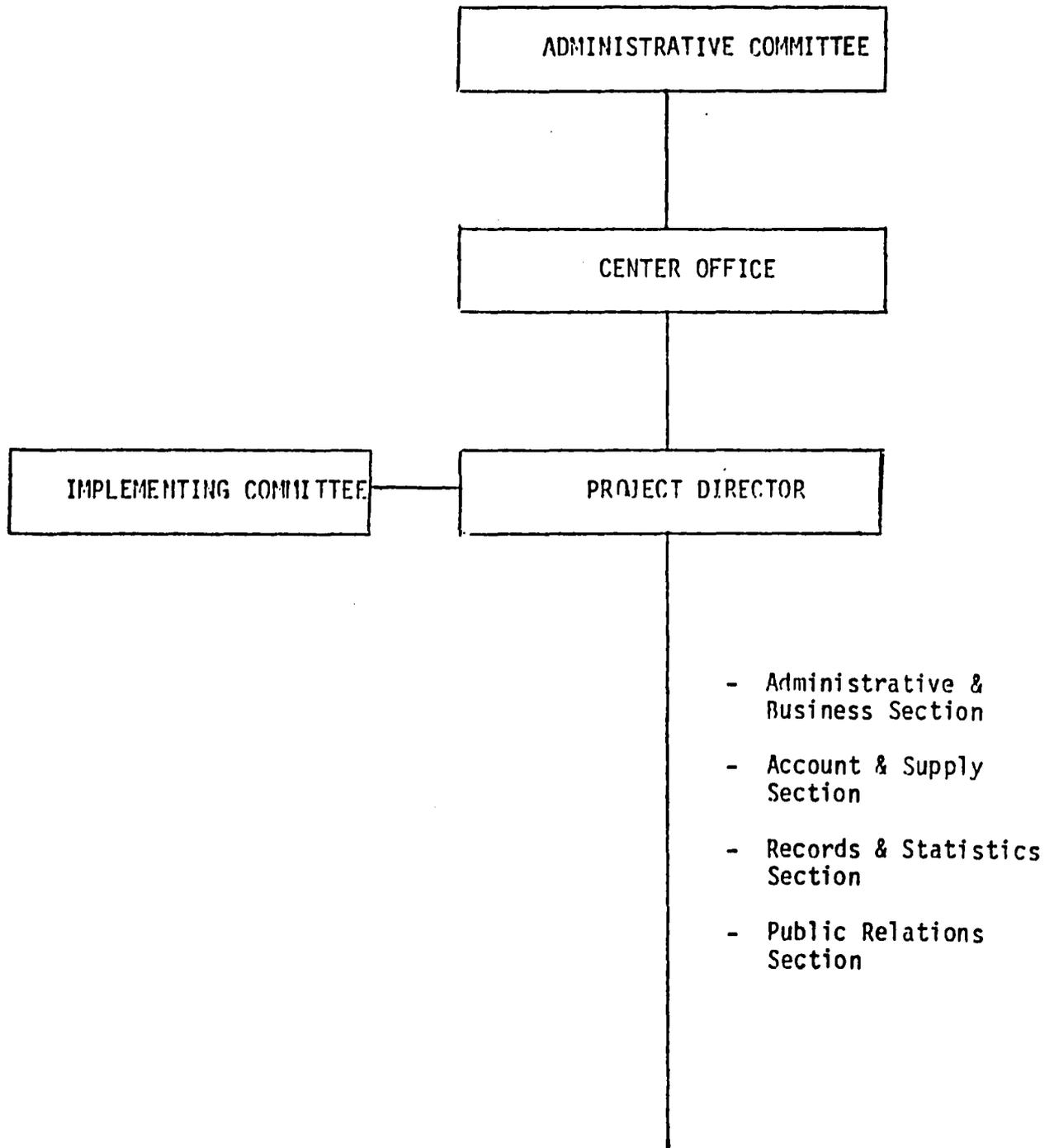
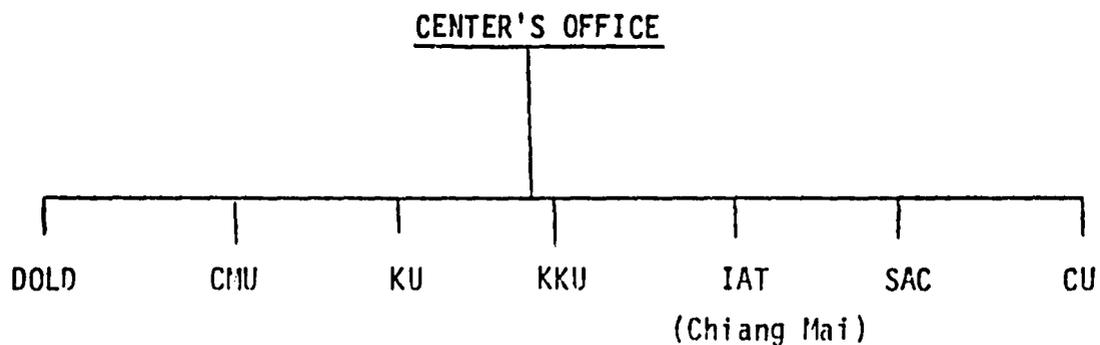


Chart No. 2

Relationship Among Collaborative Agencies



DOLD - Department of Livestock Development

CMU - Chiang Mai University

KU - Kasetsart University

KKU - Khon Kaen University

IAT - Institute of Agricultural Technology (Chiang Mai)

SAC - Surin Agricultural Campus

CU - Chulalongkorn University

Appendix 7.2. Calculations of annual opportunity costs from animal disease in Northeast Thailand, 1982

Part I. Calculation of value per head

	Total Population	Unit Wt. (Kg.)	Live Cost/Kg. (Baht)	Value/Head (Baht)
Hogs	1,172,405	100	21.2	2,119
Chickens	16,498,921	1	25	25
Ducks	4,498,591	2	25	50
Cattle	1,693,149	350	27	7,500
Buffalo	3,168,296	400	19	7,500

Part II. Calculations of total livestock value (Baht)

Hogs	1,172,405	x	2119	=	2,484,326,195
Chickens	16,498,921	x	25	=	12,473,025
Ducks	4,498,591	x	50	=	224,929,550
Cattle	1,693,149	x	7,500	=	12,698,617,500
Buffalo	3,168,296	x	7,500	=	<u>23,762,220,000</u>
			Total		39,582,566,270

Appendix 7.2 (cont. p. 2)

Part III. Calculations of potential animal value lost due to disease

39.6 billion Baht converted to U.S. dollars using
23 Baht/\$ = \$1.7 billion.

Estimating the commonly used 20 percent of value lost to disease each year one arrives at 340 million lost to disease annually. If the overall disease program can salvage 50 percent of this lost potential the potential savings are \$170 million. If the program can salvage only 10 percent of this lost potential the potential savings are \$34 million.

Source: Data for calculations in Part I are from Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, August, 1982.

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Appendix 7.3. Basic diseases which the Tha Phra diagnostic laboratory should be able to diagnose and approximate percentage of cases detectable without and with the proposed project

Disease	Specimen	Standard Laboratory Method	Functional Test System	Approximate* Sensitivity Of Positive Cases Detected	
				Presently (%)	With Additional (%)
<u>Bovine</u>					
Anaplasmosis	Serum Blood film	Serology Microscopic exam	No	20	98
			Yes		
Antrax	Spleen, blood culture	Direct smear Yes	Yes	90	90
Babesiosis	Serum Blood film	Serology Microscopic exam.	No	20	93
			Yes		
Blackleg	Carcass, tissue Culture F.A.	Gross, microscopic exam. Yes No	Yes	90	100
			No		
Brucellosis	Fetus, Placenta Serum	Culture Serology	Yes	25	95
			No		
Foot and Mouth Disease	Tissue Serum	Culture Serology	No	0	100
			No		
Infectious Bovine Rhinotracheitis	Tissue, Swab Serum	F.A. Serology (C.F.)	No	0	100
			No		
Leptospirosis	Serum (2 period)	Serology	No	0	100
Pasteurellosis H.S.	Tissue	Culture	Yes	90	90
Parasites	Fecal Sample	Microscopic exam.	Yes	75	75
Rabies Skin	Brain F.A. test	Histopathology No	Yes	80	98
			No		

Appendix 7.3 (cont. p. 2)

Disease	Specimen	Standard Laboratory Method	Functional Test System	Approximate* Sensitivity Of Positive Cases Detected	
				Presently (%)	With Additional (%)
<u>Poultry</u>					
Bluecomb	Tissue Serum	F.A. test C.F. test	No No	0	100
Avian Bronchitis	Tissue Serum	Culture F.A. test	Yes No	85	95
CRD	Tissue Serum	Culture Serology	Yes No	85	95
Coccidiosis	Tissue feces	Pathology	Yes	90	90
Laryngotracheitis	Tissue F.A.	Culture No	Yes	85	95
Newcastle Disease	Bird (live) Serology	Culture No	Yes	85	95
Pullorum	Bird Serum	Culture Serology	Yes No	85	95
<u>Swine</u>					
Aujesky's Disease	Serum	Serology	No	0	95
Erysipelas	Tissue	Culture	Yes	95	95
Hog Cholera	Tissue	Pathology	Yes	90	95
T.G.E.	Tissue	F.A.	No	0	95

*It must be understood that the figures presented are neither official nor absolute. They are included only to broadly present laboratory efficiency.

Appendix 7.4. Illustrative implementation schedule

Date	Item
April, 1983	Project approved by AID/Washington.
March, 1984	Contractor for project approved.
May, 1984	Project co-manager arrives.
July, 1984	Equipment to be used in project year one ordered for all sub-projects.
July, 1984	Terms of reference for Veterinary Consultants prepared.
August, 1984	Planning for, and implementation of, workshops begins for subject matter specialists. This work item will be continuous throughout all project years depending on seasonal workloads; therefore, no attempt is made to determine exact dates.
September, 1984	Facilities improvement for animal breeding and nutrition sub-projects initiated.
September, 1984	Initial Thai short-term consultants for training contracted.
October, 1984	Terms of reference for station management consultant prepared.

Appendix 7.4 (cont. P. 2)

Date	Item
November, 1984	Initial veterinary consultants arrive to assist in (a) equipment purchase, (b) development of training programs, (c) terms of reference for all follow-up consultants, and (d) initial planning of all veterinary sub-project activities.
November, 1984	Terms of reference for U.S. communications consultants prepared.
November, 1984	Terms of reference for NBRDC consultants prepared.
December, 1984	Animals purchased for station trials.
January, 1985	Terms of reference for purchase of Brahman and Murrah bulls prepared.
February, 1985	Cooperating farmers and villages identified for village-level breeding and nutrition projects.
February, 1985	All orders for animal health related equipment completed.
March, 1985	Animals purchased for village level breeding and nutrition trials. No attempt is made here to schedule other year's breeding and nutrition projects.
March, 1985	NBRDC consultants arrive.
March, 1985	Station management consultants arrive.

Appendix 7.4 (cont. P. 3)

Date	Item
March, 1985	Disease survey begins.
April, 1985	U.S. communications consultants arrive.
April, 1985	Brahman and Murrah bulls purchased.
May, 1985	Native Thai cattle selected and purchased.
July, 1985	Schedule and terms of reference for follow-up nutrition consultants prepared.
July, 1985	Veterinary students depart for advanced degrees.
July, 1985	At least 5 additional specialized on-farm research and extension projects identified, e.g. use of improved harness, plows, etc.
October, 1985	Non-veterinary Ph.D. and M.S. students identified and preparation made for their departure.
October, 1985	Schedule and terms of reference for initial nutrition consultants prepared.
July, 1986	Non-veterinary Ph.D. and M.S. students depart.

Appendix 7.5. Integration of Animal health, breeding,
products and economics in animal production.

Animal Production

A weakness noted in animal production at all levels in Northeast Thailand is an appreciation of how the various disciplines are used in carrying out successful animal production programs. The tendency in Thailand, as with most developing countries, is for the leaders to be over specialized in the individual disciplines. This weakness permeates the universities as well as the DOLD of the Ministry of Agriculture. The relationships of the major disciplines in animal production is shown in Figure 7.1. These relationships need to be inculcated in the minds of all leaders, thereby permitting them to impart these to the professionals and sub-professionals working in their divisions. For example, there appears to be some misunderstandings among Thai animal scientists and veterinarians regarding their roles in animal production systems. It should be made clear to animal scientists that a health program is one of the most important aspects of animal production--"A sick animal cannot be a productive one." By the same token, the veterinarian should understand that disease prevention (animal health) is more important than disease treatment. Therefore, that person must be concerned with the effects of breeds of animals and nutritional states upon animal health. All disciplines must be aware of the importance of economics when recommending practices in breeding, nutrition, health and marketing.

Appendix 7.5 (cont. p. 2)

All disciplines must cooperate in building an extension "packet" which will enable farmers to increase production and the efficiency of production. To individualistic and discipline oriented efforts will result in the imbalance now seen in Thailand, and the apparent conflict between animal scientists and veterinarians in regards to their roles in animal production. The scheme in Figure 7.1 provides a means whereby these apparent tensions can be reduced while helping all disciplines to aid the same client the livestock producer. Once the disciplines are integrated to promote efficient animal production, the next step, and a most important one, is to integrate in the minds of animal scientists, their assistants, veterinary scientists and their assistants (paravets) and extension personnel, the steps and actions to be taken in integrating crop production with animal production.

This project is dedicated to increasing animal production in the Northeast, with a special emphasis upon training and agricultural communications (extension).

Figure 7.1. The science of animal production

