

# THE LIVESTOCK INDUSTRIES OF THAILAND



Food and Agriculture Organization of the United Nations  
Regional Office for Asia and the Pacific

Animal Production and Health Commission  
for Asia and the Pacific (APHCA)



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**RAP publication no. 2002/23**

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ISBN

974-7946-25-4

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September 2002

## **Acknowledgements**

This report was prepared by Paul Riethmuller and Nawarat Chalermphao under the technical guidance of Denis Hoffmann, Senior Animal Production and Health Officer, FAO Regional Office for Asia and the Pacific (FAO/RAP) and Henning Steinfeld, Chief, Livestock Information, Sector Analysis and Policy Branch, Agriculture Department, FAO Headquarters, Rome. Assistance at various stages in preparing the report also came from Vishnu Songkitti, Chanrit Uawongkun and Rebecca Riethmuller.

The research was part of the FAO partnership programme of collaborative research with universities.

## TABLE OF CONTENTS

Acknowledgements .....	I
List of tables .....	III
List of figures .....	IV
Appendices .....	V
Executive summary .....	VII

### SECTIONS

1. Introduction .....	1
2. The beef industry .....	5
3. The dairy industry .....	13
4. The poultry industry .....	23
5. The swine industry .....	29
6. Prices of livestock and livestock products.....	31
7. The animal feed industry and livestock performance.....	35
8. Government policy .....	37
9. Other issues.....	41
10. Concluding comment .....	41

### LIST OF TABLES

1.1 Gross Domestic Product (GDP) of Thailand at 1988 prices by kind of agriculture activities, 1989-98.....	2
1.2 Livestock numbers in Thailand .....	3
1.3 Characteristics of regions in Thailand, 1994.....	4
2.1 Number of cattle by region.....	5
2.2 Distribution of cattle farms by area of farm, 1993.....	6
2.3 Distribution of cattle farms by numbers of cattle, 1993.....	7
2.4 Imports of live cattle and beef .....	11

3.1	Dairy cooperatives in Thailand.....	15
3.2	The numbers of dairy farms members, dairy cows and the quantity of fresh milk collected at different collection points, 1995 to 1999.....	16
3.3	Dairy animal numbers, the farmer's milk price and daily milk production.....	20
4.1	Production, consumption and exports of poultry from Thailand.....	25
4.2	The quantity and value of exported frozen broiler meat, 1993 to 1999.....	26
4.3	Numbers of ducks in Thailand.....	27
4.4	Features of the poultry industry, 1997 versus 2001.....	28
5.1	Numbers of holdings rearing swine, Thailand 1993.....	30
6.1	Beef cattle prices, Bangkok.....	31
6.2	Poultry inventory and farm price.....	32
6.3	Price of pigs at the farm and at the Bangkok wholesale market.....	32
6.4	Price of broilers at the farm and the wholesale Bangkok market.....	33
6.5	Price of day old broiler chick and price of day old layer chick.....	33
6.6	Price of chicken egg at farm and the Bangkok wholesale market.....	34
6.7	Price of mixed rations for different livestock.....	34
7.1	Wholesale price of animal feed at the Bangkok market, in Baht per kg.....	35
7.2	Performance of the pig industry.....	36
8.1	Tariff rates on meat produces, Thailand.....	38
8.2	Structure of investment in selected agri-food sectors, 1990.....	40

## **LIST OF FIGURES**

2.1	Beef cattle numbers by region.....	6
2.2	Distribution of beef and work cattle by area of holding and region, 1993.....	7
2.3	Distribution of beef and work cattle by size of herd and region, 1993.....	8
2.4	Buffalo numbers by region.....	10
3.1	Dairy cattle numbers by regions.....	20
3.2	Distribution of dairy cattle by herd size and region, 1993.....	21
3.3	Distribution of dairy cattle by farm area and region, 1993.....	21
4.1	Distribution of chickens by region.....	23

4.2	Distribution of birds according to the numbers of birds per holding and the type of activity, Thailand 1995 .....	24
5.1	Distribution of pigs by regions .....	29

## **APPENDICES**

A1	Characteristics of beef industry of Thailand .....	43
A2	Numbers of beef and work cattle held on farms of different areas and with different size herds, 1993 .....	44
A3	Numbers of beef cattle by region.....	44
A4	Numbers of buffalo in Thailand .....	45
A5	Dairy cattle in Thailand.....	45
A6	Numbers of dairy cattle held on farms of different sizes .....	46
A7	Chicken numbers by regions.....	46
A8	Numbers of swine in Thailand.....	47

## **Executive summary**

This report presents the characteristics of the Thailand livestock industries classified by type of livestock and examined government policy regarding the livestock sector.

Following a short introduction on the fundamental economic situation in Thailand, the characteristics of beef industry are described in section 2 including cattle and buffalo numbers, distribution and trade. Thailand had an estimated 6.7 million cattle in 1997, an increase of 2.3 million from those in 1984. The greatest proportionate increase occurred in the Northern region, while the slowest growth occurred in the Southern region. The increased mechanization that has occurred in Thai agriculture has resulted in the replacement of buffalo on many farms by tractors and other mechanical implements, this trend is likely to continue. In 1995 the buffalo numbers were 3.7 million, 28 percent below the numbers in 1984. Most of the buffalo are found in the North-east region. Thailand has imported live cattle for use as breeding animals and for fattening from Australia, New Zealand, Myanmar and Costa Rica. Cattle and primarily beef cattle were exported to Laos and Malaysia between 1991 and 1995.

Section 3 covers the history and the problems facing the dairy industry. These relate to high production costs due to high feed prices; low milk production efficiency due to poor management and poor quality animals; the use of low fat powdered milk to produce drinking milk rather than raw milk because of lower costs; and the poor quality of raw milk. Additionally, the high price of land has led to a shortage of forage while employment opportunities away from the farm for the younger generation has led to labour shortages.

Section 4 discusses the development of the broiler and layer industries. The broiler industry is completely integrated with feedmilling companies and mainly produces for export markets. The Thai poultry production system has been a great success. The layer industry began in 1950 at Kasetsart University, but rapid development only began in the mid-1970s when commercial layer hybrids were introduced from western countries. Modern management is used in the layer industry, and each bird produces 250 to 260 eggs per year.

The swine industry is examined in section 5. Pork has become the second most important meat in local consumption, with average consumption of about 4.7 kg per person per year in the late 1990s. This consumption would have been much higher were it not for the government's restrictive policies towards the slaughtering industry, which have disadvantaged the beef industry

Section 6 discusses the prices of livestock and livestock products and gives some indication of the price spread between the wholesale price and the farm gate price. It appears that the price spread for beef is wide relative to that for poultry and pig meat and this may be a disincentive for small farmers to become involved in beef cattle production.

Section 7 investigates the animal feed industry and livestock performance. Thailand has a surplus in energy feeds but a deficit in protein feeds and water scarcity is a problem for the livestock sector. As farmers do not pay for surface water, there is no incentive for them to use it efficiently. The livestock industries have experienced problems obtaining water for animals to drink, for the cleaning of animals and their pens and for cooling pigs in the summer when it is hot and dry.

The government policy related to the livestock industries is presented in section 8. Livestock industries, with the exception of the poultry and pig meat industry, have been a relatively minor part of Thailand's agricultural sector. The Fourth Economic and Social Development Plan indicated that the government should encourage industrialisation concurrently with agricultural development and give support to basic industries, supporting industries and agro-industries. The Board of Investments offered incentives designed to encourage industry to locate in rural areas outside of the Central Plains region.

Section 9 describes other issues involved in livestock industries, including finance and financial institutions. Development of new agricultural industries has been slowed by the reluctance of financial institutions to lend to farmers without land collateral. Whether this situation will persist in the medium to longer term in light of the difficulties that the Thai financial sector now faces is unclear.

The conclusion is that the information related to the livestock sector in Thailand is useful in designing policies for the livestock sector overall and for individual livestock industries. The design of appropriate policies will assume increased importance since the livestock industries are expected to grow with economic growth in Thailand.

# The livestock industries of Thailand

## 1. Introduction

Up until the mid-1990s, the Thai economy had experienced rapid growth for at least the previous 10 years. In 1995<sup>1</sup>, for example, growth was about 8.6 percent, much the same level as has prevailed through the 1990s, but below the 10.3 percent averaged between 1985 and 1990<sup>2</sup> (Thailand Development Research Institute 1997). In light of its growth performance, Thailand was considered to be one of the “tiger economies” of Asia. The period of rapid growth was brought to a halt in 1997 by the sudden depreciation of the Thai Baht (Bt). Its depreciation has been generally viewed as the catalyst for the Asian financial crisis, the effects of which are still be felt through the region.

Thailand’s population in 1999 was approximately 61.66 million and average income measured as Gross Domestic Product (GDP) per person was Bt74 152 per person, or about US\$1 853.8 at the exchange rate prevailing in 1999 - approximately Bt40 per US dollar. In 1985, Thailand’s population was 51.6 million and per person income was less than one third its 1999 level at Bt20 484 (US\$754). The growth in average income has been accompanied by an increased disparity in income distribution. In 1981, the ratio of the income share held by the top 20 percent of income earners compared to the bottom 20 percent was 9.51. In 1992, the same measure had a value of 14.35 while in 1999 it was 14.16 (Thailand Development Research Institute 1997 and 2000). Nonetheless, by some measures poverty levels have been falling. Warr (2000) presents data based upon government estimates that show rural poverty in 1962 to have been 61 percent, 27.3 percent in 1981 and 11.15 percent in 1999. Comparable estimates for urban poverty are 38 percent, 7.5 percent and 1.82 percent. The overall incidence of poverty was 57 percent, 22.98 percent and 8.58 percent for each of 1962, 1981 and 1999, respectively. A number of development programmes, pitched at the sub-district (*tambon*) or village level, have been introduced to alleviate rural poverty. One such programme in 1999 allocated Bt300 million to 1 000 villages. These programmes have included a number of different agricultural industries, including rice, maize tapioca and ducks. In the cropping industries, an increase in productivity has usually been the objective of the programme while the production of eggs for sale has been the main focus of the poultry programme (The Nation 1998).

Phongpaichit and Baker (1996) argue that Japanese investment - geared towards export oriented manufacturing industries - was the key to Thailand’s high growth rate through the 1980s and 1990s. They also argue that most of the growth in the economy occurred free of government intervention. As an indication of the extent to which foreign investment in Thailand increased during the high growth period, data from the Thailand Development Research Institute (1997) show that foreign investment in 1988 was Bt27 983 million, or over three times its level the previous year in nominal terms. By 1990, foreign investment had expanded to Bt64 695 million, only to retreat to just under Bt50 000 million in 1995. In 1999, it had grown to over four times its 1990 level to Bt209 888.3 million (Thailand Development Research Institute 1997 and 2000). Besides Japan, Hong Kong and the USA have been the other major sources of foreign investment. It is unclear what the short-term future holds for the Thai economy. High levels of non-performing loans, a slowing of growth in the US economy and the depressed state of the Japanese economy are the main factors behind the concern that many observers have expressed about the economy's prospects. Over the last couple of years, the Thai government has been relaxing regulations affecting what assets can be owned by foreign firms. Under the amended Alien Business Law, there are now thirteen parts of the economy open to foreign investors. These include food and beverage selling and the sale of food and beverages through the tourism industry. Foreign investors are permitted to own up to one rai of land for commercial use and

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<sup>1</sup> Thai government statistics are reported according to western calendar and also according to Buddhist years. The western year 2001 is 2544 in Buddhist years.

<sup>2</sup> These growth rates are for GDP at 1988 prices.

10 rai for industrial use (Srivalo 1997). Foreign investors have in general not been permitted to own agricultural land although this regulation (in early 2002 ) is in the process of being modified.

The contribution of the agricultural sector to the economy has been declining. Agriculture's share of GDP in the early 1990s was around 12 percent to 13 percent and by 1995 it had fallen to 10.9 percent (Thailand Development Research Institute 1997). This compares with 36 percent in the early 1960s (Sector Economics Program 1995). Between 1972 and 1990, agriculture grew at about 4 percent per year, while the manufacturing industry and the service industries each grew at between 8 percent and 9 percent per year. At the same time as agriculture's share of output has been declining, the relative contribution to agricultural output of cropping and livestock industries has also been falling, as Table 1.1 shows.

**Table 1.1** Gross Domestic Product (GDP) of Thailand at 1988 prices  
by kind of agricultural activities, 1989-98

Gross domestic product in agriculture								
Year	Crops	Livestock	Fisheries	Forestry	Agricultural services	Simple agricultural processing products	Total	GDP
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(mill. Bt)
1989	10.00	1.62	1.60	0.48	0.57	1.53	15.80	1 749 952
1990	8.23	1.50	1.54	0.35	0.49	1.43	13.55	1 945 372
1991	8.06	1.39	1.77	0.28	0.45	1.44	13.39	2 111 862
1992	7.76	1.33	1.76	0.25	0.41	1.47	12.98	2 282 572
1993	6.76	1.28	1.84	0.21	0.36	1.37	11.82	2 473 937
1994	6.52	1.17	1.85	0.17	0.34	1.39	11.43	2 695 413
1995	6.29	1.18	1.73	0.14	0.29	1.26	10.80	2 935 341
1996	6.30	1.04	1.60	0.13	0.28	1.22	10.56	3 109 320
1997	6.57	1.04	1.56	0.12	0.27	1.22	10.78	3 057 009
1998	5.24	0.80	1.36	0.08	0.22	0.97	8.67	3 746 128

*Source:* Office of Agricultural Economics and [www.oae.go.th](http://www.oae.go.th)

The agricultural sector in Thailand has been undergoing a substantial transformation. Agriculture has been shifting towards high valued products and non-traditional crops and away from rice, cassava and maize. Frozen chicken, sugar and canned pineapples have become important, particularly for export markets. For example, frozen chicken exports expanded in nominal terms from approximately Bt7 million (or 0.02 percent of agricultural exports) to Bt8886 million (2.65 percent of agricultural exports) between 1975 and 1993 (Sector Economics Program 1995). Growth in the nominal value of frozen poultry exports has continued so that by 1999, frozen poultry exports were worth Bt15 450 million. The restructuring of agriculture has come about through a series of government initiatives, some of which are outlined in Siamwalla (1996) and Sector Economics Program (1995).

The livestock sector is only a relatively small part of the overall agricultural sector. Livestock industries such as the dairy and the beef industries are almost insignificant parts of the Thai economy in terms of aggregate output. The data in Table 1.1 show livestock has contributed only 0.8 percent to 1.62 percent over the period 1989 to 1998. Moreover, the share has been declining. Within the livestock sector, development has been uneven. On the one hand, rapid growth has occurred in dairy cattle numbers. Between 1986 and 1999, dairy cattle numbers increased more than fourfold. On the other hand, the number of beef cattle increased by less than 10 percent. Chicken, pig and duck numbers also increased while buffalo numbers declined (Table 1.2).

**Table 1.2** Livestock numbers in Thailand

Year	Beef cattle (000)	Dairy cattle (000)	Buffalo (000)	Pigs (000)	Ducks (000)	Chickens (000)
1985	Na	na	5 252	5 919	19 398	70 021
1986	4 288	64	4 981	5 873	19 966	87 324
1987	4 331	68	4 684	5 867	19 831	92 134
1988	4 501	95	4 620	5 740	15 934	89 812
1989	4 987	133	4 612	6 015	16 683	96 594
1990	5 510	158	4 694	7 350	17 902	107 559
1991	6 436	191	4 805	8 202	19 124	130 837
1992	6 899	222	4 728	8 333	19 345	135 176
1993	7 235	237	4 804	8 569	21 779	138 832
1994	7 406	232	4 225	8 479	21 812	129 997
1995	7 322	287	3 710	8 562	18 897	111 649
1996	5 854	276	2 720	8 708	21 925	144 579
1997	5 292	303	2 294	10 139	21 830	164 686
1998	4 568	295	1 951	8 772	19 748	155 325
1999	4 636	283	1 800	7 423	22 330	169 633

*Source:* Department of Livestock Development (1996) and [www.dld.go.th](http://www.dld.go.th)

Thailand is a diverse country agriculturally, and so some of the data in this report will be on a regional basis. The regions defined by the Thai authorities follow and Table 1.3 provides the following classification:

- Northern region - this is bordered by Myanmar to the west and China to the north.
- North-Eastern region - this region borders Laos in the north and Cambodia to the east.
- Central region - this region is in the central part of the country and includes the capital Bangkok
- Southern region - this region has Malaysia as its southern border.

Table 1.3 shows that more than half (51.5 percent) of Thailand's GDP in 1994 was generated in Bangkok. The Central region contributed 19 percent, the North-eastern region 11.3 percent, the Northern region 9.5 percent and the Southern region 8.6 percent. The North-eastern region was home to about 34 percent of Thais in the mid-1990s. It is generally regarded as the poorest of the regions, and this is borne out by the estimates of per person GDP. Table 1.3 shows that in 1994, per person GDP in the North-east region was Bt20 235, while in the Central region it was more than three times this. It is apparent from the information in Table 1.3 that vegetables and fruit growing have become more important industries over the last two decades since the area given over to these two industries in all of the regions has increased. Finally, less than 50 percent of Thai farmers in each of the four regions are solely dependent upon agriculture for their income.

**Table 1.3** Characteristics of regions in Thailand, 1994

Item	Unit	North east	North	South	Central	Bangkok
<b>GDP</b>	mill. Bt	405 960	343 478	308 085	687 490	1 855 894
Contribution of agriculture	%	20.94	16.81	30.06	21.10	11.08
Population	mill.	20 10	11.1	7.7	9.9	10.0
Per person GDP	Bt	20 235	31 064	39 789	69 598	186 167
Land area	000 ha	16 685	16 954	7 072	10 390	-
Farm size <sup>a</sup> (1975)	ha	4.33 (4.54)	3.82 (3.63)	3.72 (3.76)	5.26 (5.33)	-
Paddy land <sup>a</sup> (1975)	000 ha	6 327 (5 454)	2 507 (2 533)	562 (719)	2 060 (2 692)	-
Field crops (1975)	000 ha	2 211 (1 204)	1 714 (970)	19 (17)	1 522 (1 001)	-
Fruit trees <sup>a</sup> (1975)	000 ha	320 (75)	322 (99)	2 091 (1 151)	741 (341)	-
Vegetables and ornamentals <sup>a</sup> (1975)	000 ha	33 (13)	49 (11)	12 (5)	55 (29)	-
Grassland <sup>a</sup> (1975)	000 ha	75 (49)	18 (6)	6 (15)	25 (8)	-
No. of agricultural holdings						
• 1978	000	1 660	1 004	564	789	-
• 1993	000	2 506	1 408	799	934	-
Size distribution of holdings in 1993 (1978)						
• under 6 rai <sup>b</sup>	%	13.2 (10.2)	29.1 (24.3)	21.2 (17.6)	22.0 (15.9)	-
• 6 to 9 rai	%	12.4 (10.6)	15.6 (15.2)	15.2 (15.5)	9.9 (8.6)	-
• 10 to 39 rai	%	61.7 (62.4)	44.7 (46.7)	52.5 (56.9)	50.4 (53.0)	-
• 40 rai and over	%	12.7 (16.8)	10.6 (13.8)	11.1 (10.0)	17.7 (22.5)	-
Source of household income 1993						
• Agriculture only	%	45.64	47.00	44.77	46.48	-
• Mainly agriculture	%	30.91	29.53	21.81	29.3	-
• Mainly from agricultural work	%	1.87	2.19	5.28	3.09	-
• Mainly from other sources	%	14.36	15.71	22.42	15.28	-
• Equally from agriculture and other sources	%	7.12	5.57	5.72	5.85	-

**Notes:** <sup>a</sup> Data for 1992; <sup>b</sup> 1 rai is 0.16 ha.

**Source:** Thailand Development Research Institute (1997); National Statistics Office (nd); Chandhanamutta (1991)

Besides these broad differences, there are other features of the regions that need also to be recognized as they might influence economic activity. As an example, it seems that the location of farmer's houses varies between regions. The Sectoral Economics Program (1995) points out that farmers in the Central region, the lower part of the Northern region and most of the North-eastern region build their houses in a cluster or in a strip village, usually at some distance from their farms. This means that for these farmers the raising of expensive livestock is risky because of the increased possibility of theft. Thai farmers have been found to be risk averse according to research by Binswanger and others, cited by the Sectoral Economics Program (1995). With the exception of the Northern region, the average size of farms in Thailand has decreased. This reflects the fact that land availability for agricultural purposes is very limited due to increased population pressure and government policies that have reclassified some land into national parks and other regions quarantined from further agricultural development.

## 2. The beef industry

In their review of the Thai agricultural sector, Siamwalla, Setboonsarng and Patamasiriwat (nd) explain that starting around 1970 and coinciding with the introduction of second cropping in the Chao Phraya delta, ploughing of paddy lands began to be done by two-wheeled or four-wheeled power tillers. This led to a drawing down of the stock of buffaloes and cattle, resulting in only a very slow growth in value adding from beef cattle and buffaloes. They argue that only recently has the high income elasticity of demand for beef begun to have an impact on domestic beef production<sup>3</sup>.

According to the official statistics, Thailand had an estimated 6 778 445 cattle in 1997, or over 2 300 000 more than in 1984. The greatest proportionate increase occurred in the Northern region, where cattle numbers almost doubled between 1984 and 1997 while the slowest growth occurred in the Southern region. About 40 percent of the cattle in 1997 were in the North-Eastern region of the country. The Thai government has been trying to increase the numbers of improved varieties of cattle such as Simbrah and Charbray since the authorities view these as being suitable for Thai conditions. According to the Department of Livestock Development (1996), these two breeds are not yet available to farmers but they are expected to be released to farmers for commercial use in 2008. Beef cattle make up most of the cattle herd. Beef cattle numbers in 1995 were 7321 821 (Figure 2.1). The main beef region is the North-eastern region where 38 percent of Thailand's beef cattle were to be found in 1997. The changes in beef cattle numbers across the region were almost the same as for cattle overall. There has been a change in the relative importance of the regions between 1986 and 1995 with the Northern region becoming more important, while the Central region has declined in relative importance as a beef producing region.

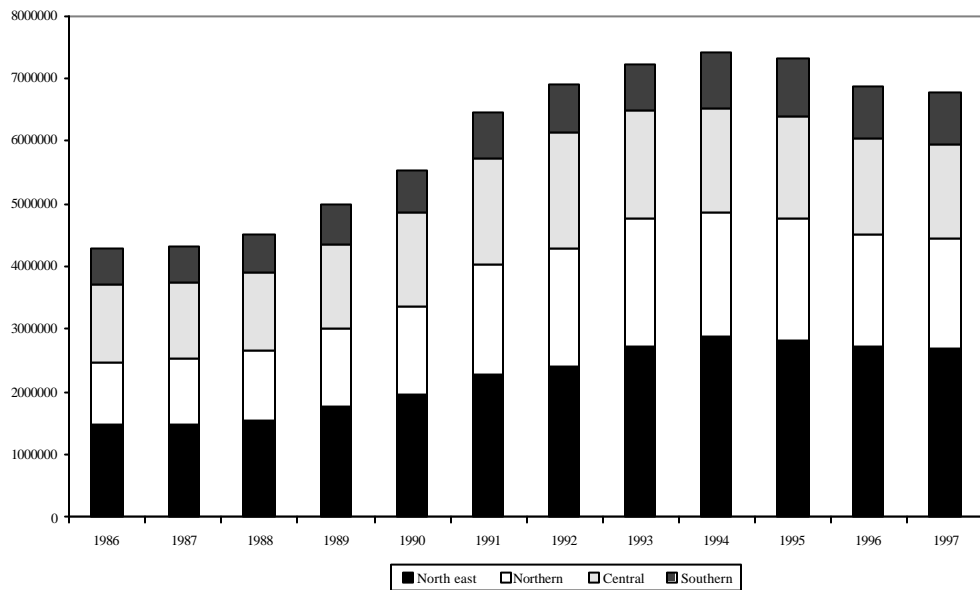
**Table 2.1** Numbers of cattle by region

Year	Central	North east	North	Southern	Total
1984	1 211 084	1 705 956	964 539	632 360	4 408 026
1985	1 128 222	1 621 356	950 074	614 835	4 314 487
1986	1 262 792	1 507 441	984 425	596 803	4 351 461
1987	1 248 734	1 495 130	1 057 398	597 837	4 399 099
1988	1 306 093	1 568 405	1 128 636	592 533	4 595 667
1989	1 466 655	1 778 850	1 249 874	624 338	5 119 717
1990	1 597 579	1 984 419	1 428 038	658 494	5 668 530
1991	1 855 842	2 312 023	1 741 763	717 343	6 626 971
1992	2 014 757	2 456 732	1 878 499	771 491	7 121 479
1993	1 878 611	2 759 514	2 067 026	767 422	7 472 573
1994	1 823 300	2 922 302	2 001 500	890 248	7 637 350
1995	1 812 960	2 890 894	1 972 643	932 571	7 609 068
1996	1 508 165	2 723 841	1 791 442	854 759	6 878 207
1997	1 478 934	2 688 419	1 770 144	840 948	6 778 445
1997/1984	1.22	1.58	1.84	1.32	1.53

**Source:** Department of Livestock Development (1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data. Data for 1996 and 1997 came from [www.dld.go.th](http://www.dld.go.th)

<sup>3</sup> The following are estimates of the income elasticity of demand for various food items: cereals 0.06; beef 0.56; pork 0.47; poultry 0.50; cow milk 0.80; and eggs 0.50 ([www.courses.psu.edu/intag100\\_uib/sections/section11.pdf](http://www.courses.psu.edu/intag100_uib/sections/section11.pdf))

**Figure 2.1** Beef cattle numbers by region



About 55 percent of the farms in the cattle industry (this includes dairy as well as beef cattle) had a land area of between 10 and 40 rai in 1993. There did not appear to be any difference in the land area of farms between the regions. Only 0.6 percent of the 1263 431 farms with cattle in 1993 had farm areas of 140 rai or more. The farms with the greatest area of land were more likely to be in the Central region in 1993 (Table 2.2).

**Table 2.2** Distribution of cattle farms by area of farm, 1993

Farm area (rai)	North east (%)	Northern (%)	Central (%)	Southern (%)	All Kingdom (%)
Less than 2 rai	3.11	7.90	12.00	2.91	5.20
2 - 5	7.40	21.20	12.15	16.37	12.31
6 - 9	9.56	14.98	8.20	15.72	11.54
10 - 19	28.63	24.41	22.28	30.24	27.27
20 - 39	33.30	19.12	26.29	23.87	27.92
40 - 59	11.44	6.92	10.59	6.77	9.60
60 - 139	6.10	4.72	7.18	3.69	5.54
140 and over	0.44	0.74	1.31	0.42	0.62
<b>Total farms</b>	<b>613 738</b>	<b>232 959</b>	<b>177 040</b>	<b>239 694</b>	<b>1 263 431</b>

*Source:* National Statistics Office (1966a, 1966b, 1966c, 1966d)

Almost one third of farms carrying cattle in 1993 had either one or two animals, while a further 51 percent had between three and nine animals. About one percent of farms had more than 50 head, and less than a quarter of one percent of farms had 100 head of cattle or more. As was the case with farm area, the Central region had the highest concentration of farms with 100 or more head of cattle (Table 2.3). The data in Table 2.2 and 2.3 confirm the point made earlier about the cattle industry being largely a small farm industry.

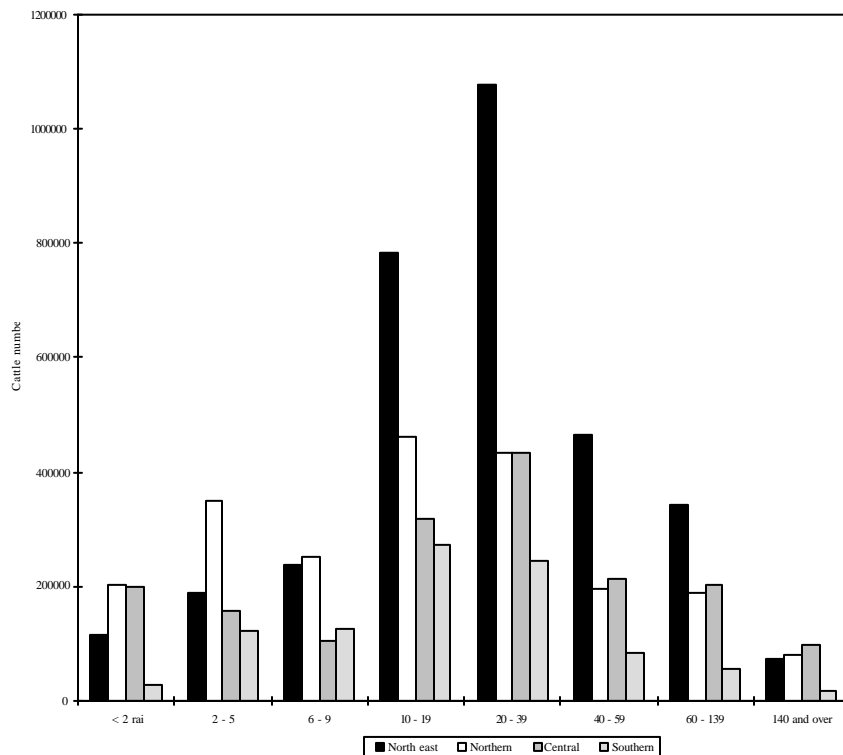
**Table 2.3** Distribution of cattle farms by numbers of cattle, 1993

Number of cattle	North east	Northern	Central	Southern	All Kingdom
	(%)	(%)	(%)	(%)	(%)
1 - 2	33.80	29.90	18.78	39.51	32.06
3 - 4	28.88	19.96	23.45	33.82	27.41
5 - 9	25.27	22.28	27.66	21.12	24.27
10 - 19	8.74	15.43	16.59	4.35	10.24
20 - 49	2.90	10.17	10.09	1.00	4.89
50 - 99	0.36	1.96	2.63	0.16	0.94
100 - 499	0.05	0.31	0.79	0.05	0.20
500 and over	<0.01	<0.01	0.02	<0.01	<0.01
<b>Total farms</b>	<b>613 738</b>	<b>232 959</b>	<b>177 040</b>	<b>239 694</b>	<b>1 263 431</b>

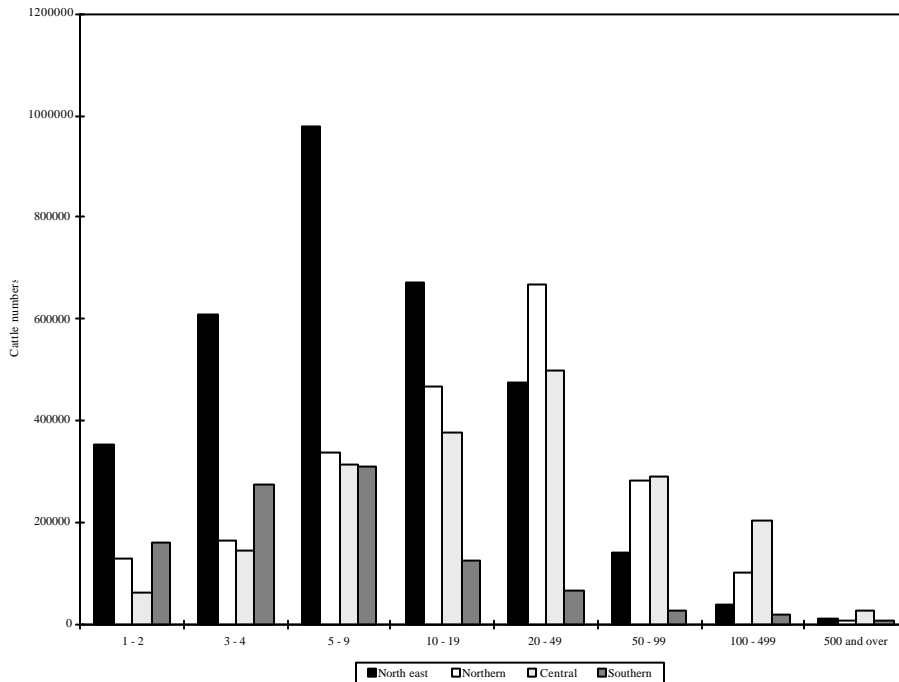
*Source:* National Statistics Office (1966a, 1966b, 1966c, 1966d)

Figure 2.2 and Figure 2.3 show the distribution of the number of beef and work cattle by the area of the farm and the number of cattle on the farm, respectively, for each region. It may be seen from these two figures that most cattle are to be found on farms that are small in terms of farm area and also in terms of herd size. Indeed, for Thailand as a whole, there were 8 336 874 beef cattle in 1993 and 2 186 641 were on farms with between 20 and 49 rai of land. These farms made up about 28 percent of farms with cattle in 1993. The very smallest farms - those with an area of less than 2 rai - carried 541 008 cattle. The limited land area that the majority of farms have available to them means that obtaining feed is likely to be a problem for the operators of these farms, particularly during the dry season.

**Figure 2.2** Distribution of beef and work cattle by area of holding and region, 1993



**Figure 2.3** Distribution of beef and work cattle by size of herd and region, 1993



A major problem that the beef industry faces is smuggling from Myanmar<sup>4</sup>, which Thailand borders on the west. According to the Department of Livestock Development (1996), the number of smuggled cattle is about 400 000 per year. Smuggled cattle are sold in Thailand at prices lower than Thai farmers are willing to accept for locally reared animals. The cattle from Myanmar are said to harbour diseases including foot and mouth disease. This makes it difficult for Thailand to successfully implement control programs for diseases such as foot and mouth disease in ruminants and in pigs. Thai export opportunities for both of these industries are therefore somewhat limited. A second problem that the industry faces is the government regulation of slaughtering facilities. These are under the control of the Ministry of the Interior and this creates difficulties for the Ministry of Agriculture in implementing programs for the cattle industry.

The Department of Livestock Development (1996) has identified a number of other problems that also confront the Thai beef industry. These are as follows:

Efficiency in beef production is low. This is related to a number of factors. First, most breeds used to produce beef in Thailand are low yielding. Second, the lack of attention paid to animals by farmers resulting in low birth weights and high mortality rates, particularly among young animals.

- There is little incentive for the development of commercial farms because of scarcity of land and high levels of investment required. The Department of Livestock Development reports it can take up to three years for the investment to be recouped.
- There is no “standard price” for beef cattle and markets are not well developed.
- The beef produced in Thailand is not up to export standard because of poor beef processing procedures and facilities.

<sup>4</sup> Myanmar, known also as Burma, is larger than Thailand with an area of 676 000 km<sup>2</sup>, as compared to Thailand’s 513 000 km<sup>2</sup>. Its population is about 46 million.

According to the Department of Livestock Development, there are a number of possibilities open to the industry that gives ground for some optimism.

- It should be possible to reduce the mortality rate of calves from the level of the late 1990s - about 65 percent - to around 40 percent through the control of parasites in young animals.
- The control of smuggling should allow prices to increase.
- The investment needed to enter the industry could possibly be reduced through development of two types of farms - breeder farms and farms exclusively for fattening.
- There is a potential demand in Malaysia of 30 000 to 40 000 head of cattle per year.
- The southern part of Thailand has the right agronomic conditions for beef production. It is also close to potential markets and faces less of a disease problem than other parts of the country.
- Introducing modern meat plants would be an incentive for farmers to improve the quality of their production.
- Waste from beef farms could be used as an organic fertilizer resulting in less damage to the environment than chemical fertilizers.

The broad strategies that the Thai government introduced for the cattle industries for period 1997 to 2001 have the following components. First, the government continued with the demonstration of the three central markets set up as part of the Seventh Development Plan in an attempt to convince farmers of the benefit of a central market. It is expected to lead to the establishment of a beef cattle market with beef quality as a guide in trading. Second, the government sponsored research program into breeding the most suitable animals will continue and the government will produce Brahman parent stock to distribute to beef cattle improvement centres for later sale to farmers. Third, common grazing areas will be set up from available public land. Fourth, vaccines and chemical treatments will be made available to farmers to control foot and mouth disease and parasitic infestation. Fifth, farmers will be divided into two production groups, with one concentrating on breeding and the other on fattening. To assist in this, the government will give long term credit to farmers. Finally, the government will attempt to control the smuggling of cattle as a way of improving the beef price.

## **2.1 Buffaloes**

Buffalo numbers in 1995 were 3 710 061, or about 28 percent below their numbers in 1984 (Figure 2.4). Most of the buffalo are to be found in the North-eastern region which, as mentioned earlier, is the poorest region of Thailand. Although there were some farms in each of the regions that had 10 or more buffalo, these tended to be the exception rather than the norm. Most farms had one or two buffalo. This reflects the importance of buffalo as draft animals and their suitability for the Thai environment. The increased mechanisation that has occurred in Thai agriculture has resulted in the replacement of buffalo on many farms by tractors and other mechanical implements. This trend is likely to continue.

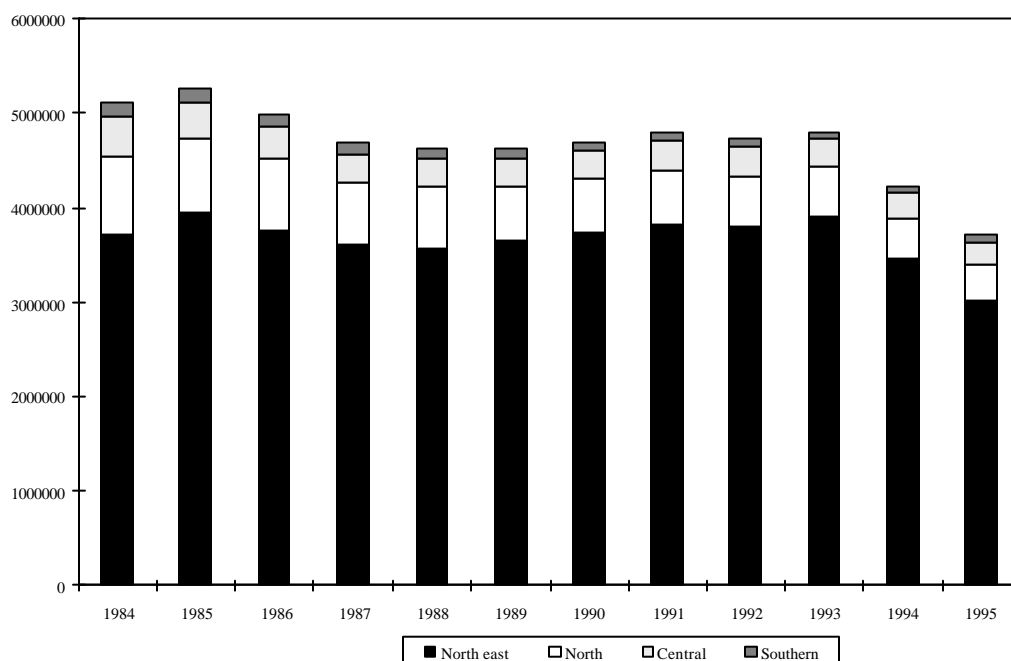
For buffalo and beef cattle raised on extensive farms, the following are points made by Noppakun (1998):

- Buffalo fertility is poor and calving rates are around 55 percent;
- Calving intervals are long, up to 18 to 22 months;
- Rearing losses are high and are of the order of 30 percent;

- Daily weight gain is low so that calves are not likely to calve until they are 44 to 50 months of age;
- The draught performance of the animals is poor and there is no targeted utilization of meat.

A different view about the production performance of buffalo would be that they have developed the characteristics listed above as an adaptation to their environment, and as a way of ensuring their survival in conditions that are difficult with limited inputs.

**Figure 2.4** Buffalo numbers by region



## 2.2 Live cattle and beef trade

Thailand has imported live cattle for use as breeding cattle and for fattening from a number of countries, including Australia, New Zealand, Myanmar and Costa Rica. Not all of the programs involving breeder cattle have been successful, with cattle sometimes failing to get into calf most usually because of poor nutrition. According to industry sources, this has made farmers reluctant to borrow money to purchase the imported cattle. The data in Table 2.4, for example, show that breeder cattle imports declined from over 15 000 in 1993 to under 1 000 in 1996. Most of these breeders have some Brahman blood and they usually come from northern Australia. The large number of imports in 1991 was the result of a Thai government program to increase the domestic cattle population through dispersing imported cattle to farmers. Kaus et al (1997) point out that this particular scheme suffered in its early stages as farmers did not have adequate cattle management skills. The Australian beef industry in conjunction with the Thai Department of Livestock Development set up model farms where Thai farmers obtain technical advice and observe improved management practices. Imports of cattle other than breeders have expanded in the last couple of years. These cattle are mainly cross breed dairy animals (similar to the Australian Fresian Sahiwal) and they have been dispersed to small holders. The future of imports of live cattle is sensitive to exchange rate movements and developments in other export markets for Australian cattle and beef such as Japan, Korea and the United States of America. The currency instability in the latter part of 1997 saw the live trade

involving Australia all but disappear. Beef imports into Thailand have been relatively minor and are made mainly for the restaurant or hotel sector.

**Table 2.4** Imports of live cattle and beef

Year	Breeder imports		Other live cattle imports		Beef imports	
	No.	Value (000 Bt)	No.	Value (000 Bt)	Volume (t.)	Value (000 Bt)
1989	7 073	304 975	1 918	3 377	125.87	25 989
1990	11 090	367 810	1 282	3 564	110.8	25 140
1991	18 426	588 556	12 197	18 780	809.59	77 663
1992	7 978	270 601	2 301	4 279	1 217.99	100 443
1993	15 188	196 567	7 425	11 335	2 250.64	123 431
1994	4 339	167 674	4 875	9 673	1 070.01	81 148
1995	1 419	79 178	14 074	31 132	1 390.54	95 263
1996	235	20 180	20 163	38 589	1 164.62	na
1997	2 221	na	17 712	678 700	1 655.33	na
1998	207	na	79 338	5 772 600	2 021.26	na
1999	24 935	na	138 342	5 258 2400	1 785.3	na
2000	na	na	66 836	na	na	na

**Source:** Office of Agricultural Economics (pers. comm. 7 May 1997) and [www.oae.go.th](http://www.oae.go.th)

Thailand has exported cattle to Malaysia and to Laos over the last decade. Between 1991 and 1995, just over 43 000 cattle were exported, with 868 going to Laos and the others to Malaysia. These cattle have been primarily beef cattle. As noted earlier in this section of the report, the Thai government is making the trade with Malaysia a priority.

### 3. The dairy industry

As is the case in most developing countries, cattle in Thailand were used primarily for draught and for meat production and not for dairy farming (Suzuki 1997). Hence the dairy industry remained of very small size until relatively recently. It is said that Indian migrants started dairy farming in Thailand in the eighteenth century. According to Chantalakhana (1995), dairy farming in Thailand during the 1940s and 1950s was unimportant, and mainly in the hands of dairy cattle raisers of Indian or Pakistani origin living in the suburban areas of Bangkok. Chantalakhana points out that the promotion of dairy farming was confined to experimental scale farms operated by the Department of Livestock Development and Kasestart University, which at the time operated under the Ministry of Agriculture and Cooperatives. In the 1950s, the distribution of powdered milk to government health clinics and schools took place under a joint program between the United Nations and the Thai government. This programme made Thai people familiar with milk and provided a foundation for the subsequent development of the dairy industry. In 1956, a Dutch company started producing plain and flavored milk in Bangkok (Suzuki 1997).

Thirasuttakorn (1995) explains that the systematic development of the Thai dairy industry only really began in the early 1960s when His Majesty the King of Thailand became interested in the Danish dairy industry following a visit by the King to Europe. This led to the establishment of the first dairy - the Thai-Danish Dairy Farm - at Muak Lek in Saraburi Province (to the north-east of Bangkok) in 1962. When the cooperation program between Denmark and the Thai government finished, the Dairy Farm Promotion Organisation (DFPO) took over the project farm<sup>5</sup>. Since then, the DFPO has played an important role in introducing technology to farmers and organizing dairy cooperatives in the central region. It was privatized in the mid-1990s, but still works as one of the largest producer organizations in the country (Suzuki 1997).

It seems that while the industry was to play a role in the improvement of Thai diets and in saving foreign exchange, perhaps of more importance was the industry's perceived ability to contribute to the social objective of improving the incomes of poor producers and rural households with little or no land. According to Danida (1995), this latter goal is the criterion that should be used to evaluate the industry. Polvatanasug (1995), on the other hand, has the view that the objective of the government for the industry is to progressively replace imports of dairy products by local production. Pichet (1991) adds the generation of employment and the development of milk processing and dairy product manufacturing to these objectives.

The dairy industry received a boost in 1978 when the Dairy Farm Promotion Organisation of Thailand drew up what turned out to be an ambitious 10 year plan to raise fresh milk production to a level necessary for self-sufficiency. In 1983 the Ministry of Industries introduced a regulation affecting skimmed milk imports. This regulation involved a mixing ratio. It required producers of pasteurized or ultra-heat treated milk to use at least one part of raw fresh milk for every part of recombined milk (Chantalakhana 1995). Also in 1983, the Ministry of Commerce introduced a permit system for milk imports. According to Chantalakhana (1995), under arrangements that existed in 1995, imports are allowed provided the firm involved in importing guarantees "to purchase 20kg of fresh milk for each

The dairy industry remains largely under the control of the Ministry of Agriculture and Cooperatives. There are a number of other agencies that also influence the industry, with the most important of these being the following.

- The Dairy Farming Promotion Organisation is a state enterprise that was established in 1971. Its broad objectives are to promote dairy farming; to provide training in dairy husbandry through extension work; and to develop the processing of milk products.

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<sup>5</sup> Chantalakhana (1995) refers to this organisation as the Dairy Promotion Organisation of Thailand. The handover to Thailand of the Thai-Danish Farm in 1971 was followed by the handover in late 1977 of the Thai-German Dairy Farm to the Department of Livestock Development. This latter operation started in 1965.

- Support services similar to those provided by the Dairy Farming Promotion Organisation are provided by the Department of Livestock Development. These include training, extension, veterinary services and artificial insemination.
- The Bank of Agriculture and Agricultural Cooperatives (BAAC), a semi-government institution, is the main lender to the agricultural sector in Thailand including the dairy industry.
- The government organisation responsible for the promotion and supervision of cooperatives is the Cooperative Promotion Department. It encourages the establishment of cooperatives with the objective of improving the standard of living of their members. It also monitors the management and operation of the cooperatives to ensure that they run according to government regulations.

The Thai industry is organized along cooperative lines. Thirasuttakorn (1995) explains that there are a number of basic requirements to form a cooperative. There must be a minimum of 60 farming families, with at least 300 cows between them. The distance from the milk collection point should be no more than 20 km and there should be an approved market for the milk. Importantly, the intending cooperative should have veterinary and artificial insemination facilities available. Not just any farmer can become a cooperative member. Farmers have to have passed a training course on dairy farming and have a minimum of 10 rai of land and preferably a minimum of 5 cows. Danida's view is that the five cow requirement has resulted in an industry based upon a "small rural elite" (p.6).

In 1994, there were 63 primary dairy cooperatives in Thailand, operating under the umbrella of the Dairy Cooperative Federation of Thailand. There were about 12 500 dairy farmers and no more than 50 000 milking cows (Danida 1995). This compares with 114 cooperatives in 1962 (Chantalanhaka 1995). Most farmers raise three to five dairy cows, although some farmers have as many as 10 cows. About one percent had more than 40 cows. Seven of the dairy cooperatives had processing units in 1994. The cooperatives also operate feed mixing plants to meet the animal feed requirements of members and they also provide technical advice and training to members.

Thirasuttakorn (1995) points out that the cooperatives often lack the financial resources to invest in milk collection facilities and in transport and processing facilities. She also indicates that the limited number of people in the dairy cooperatives with an adequate knowledge of management, accounting and extension is a problem for the industry. It seems that for many cooperatives, in the early 1990s, the scarcity of trained personnel resulted in them being run by government officers. Cooperative members had little, if any, say in the operation of the cooperatives.

The largest dairy cooperative is the Nong Pho Dairy Cooperative in Ratchaburi Province. Set up in 1977 with the help of a government grant (Prohmtong 1991), it is located about 70 km south west of Bangkok and had 4 358 members in 1992. The Nong Pho Dairy Cooperative has received strong support from the Thai royal family and expanded its activities to include a dairy factory and an animal feed manufacturing plant. Since 1980, it has operated a milk plant capable of producing ultra-heat treated milk. Prohmtong (1991) provides details of the establishment of other dairy cooperatives in Thailand as well, and explains the nature of the support that the government has given to the cooperatives. In brief, this assistance has included the following:

- The provision of money to cooperatives for investment in cattle and equipment;
- Training of farmers through extension programs in dairy cattle management and dairy cattle health;
- Training and education of cooperative management; and
- The provision of loans to farmers for animal feed and for the purchase of animals.

For their part, the cooperatives engage in the activities listed below.

- The operation of milk collection centres where the farmer can ship milk. This milk is purchased at a base price adjusted for butterfat content, protein content, bacterial count, sediment, water content and farm hygiene.
- The processing of milk or the sale of the milk to other processors.
- Operating feed mills to produce feed concentrate and feed rations for members.
- The bulk purchase of equipment used by dairy farmers on their farms.
- Providing extension services to farmers to improve farm management.
- Facilitating loans from the Bank for Agriculture and Agricultural Cooperatives.
- Running seminars to improve management practices.

Some of the features of the dairy cooperatives in Thailand are shown in Table 3.1 and in Table 3.2.

**Table 3.1** Dairy cooperatives in Thailand

Item	Unit	1988	1989	1990	1991	1992	1993
Purchasing business							
• Feedstuffs	mill Bt	103	122	179	216	217	
• Consumer goods	mill Bt	39	46	50	47	54	
Selling business							
• Raw milk	mill Bt	115	164	294	356	487	
• Consumer goods	mill Bt	450	577	736	824	886	
Number of dairy cooperatives		27	35	40	50	56	58
Number of members		7 616	9 422	10 949	11 876	13 256	13 358
Number of milking cows							48 718
Number of dairy cows							123 237
Number of milk collecting centres							38
Raw milk collected	t/yr	82 463	79 011	100 944	120 404		123 370
Number of processing factories							14
Number of feed stuff factories							9

Because of the time and labour constraints facing the farmer, dairy farming is generally only combined with the raising of poultry (Chantalakhana 1995). Farmers, organised into 32 different zones or groups depending on their location in relation to the cooperative of which they are a member, receive payment for milk on the 5<sup>th</sup>, the 15<sup>th</sup> and the 25<sup>th</sup> of each month. The price they receive is based upon the fat content of the milk as well as its bacterial count (Chantalakhana 1995).

**Table 3.2** The numbers of dairy farmer members, dairy cows and the quantity of fresh milk collected at different collection points, 1995 to 1999

Year	Number of farm members		Number of dairy cows		Fresh milk production (t.)		Price (Bt/kg)	Value of production (Bt'000)	Milk collecting point
	Total	Dairy farms	Total	Milk cows	Annual	Daily			
<b>1995</b>	22 462	15 582	230 061	99 456	307 229.00	841.72	8.14	2 501 670	From all point
	5 819	3 457	57 285	24 591	70 803.95	193.98	7.97	564 504	▪ From DFPO.
	4 367	2 167	40 250	17 208	52 535.76	143.93	7.98	419 095	▪ Muaglek, Saraburi
	825	733	12 424	4 994	15 933.93	43.65	7.94	126 571	▪ Prachuap Khiri Khan
	131	129	1 184	459	1 577.89	4.32	8.13	12 833	▪ Chiang Mai
	496	428	3 427	1 930	756.37	2.07	7.95	6 004	▪ Khon Kaen
	13 790	9 505	136 629	59 182	185 612.47	508.53	8.14	1 511 534	▪ Other Co-operatives
	167	149	3 011	1 011	3 199.47	8.77	8.16	26 102	▪ Educational Institute
	2 686	2 471	33 136	14 672	47 613.11	130.45	8.39	399 528	▪ Others
<b>1996</b>	25 188	18 639	274 613	130 434	343 387.72	940.79	9.19	3 156 890	From all point
	5 898	3 555	60 220	24 717	72 930.23	199.81	9.25	674 409	▪ From DFPO.
	4 158	2 017	40 120	16 528	47 649.60	130.54	9.24	440 122	▪ Muaglek, Saraburi
	1 034	862	12 930	4 998	16 687.79	45.72	9.3	155 265	▪ Prachuap Khiri Khan
	134	130	1 262	496	2 195.84	6.02	9.13	20 031	▪ Chiang Mai
	572	546	5 908	2 695	6 397.00	17.53	9.22	58 989	▪ Khon Kaen
	15 525	11 946	165 222	80 876	200 827.27	550.21	9.12	1 832 390	▪ Other Co-operatives
	179	179	3 049	1 010	3 248.04	8.9	8.93	28 988	▪ Educational Institute
	3 586	2 959	46 122	23 831	66 382.18	181.87	9.36	621 102	▪ Others

<b>1997</b>	23 646	16 981	288 856	126 136	385 728.05	1 056.76	9.39	3 622 573	From all points
	4 361	3 471	60 534	22 953	74 776.90	204.87	9.86	737 635	▪ From DFPO
	2 100	1 676	36 965	13 606	44 039.47	120.66	9.98	439 522	▪ Muaglek, Saraburi
	976	717	11 866	4 859	17 712.59	48.53	10.06	178 125	▪ Prachuap Khiri Khan
	318	198	1 722	590	2 422.58	6.64	9.26	22 444	▪ Chiang Mai
	765	704	7 793	3 011	8 875.66	24.32	9.2	81 673	▪ Khon Kaen
	202	176	2 188	887	1 726.60	4.73	9.2	15 869	▪ Sukhothai
	15 021	9 588	169 853	78 639	220 101.50	603.02	9.23	2 032 503	▪ Other Co-operatives
	79	70	2 321	624	2 272.86	6.23	9.47	21 506	▪ Educational Institute
	4 185	3 852	56 148	23 920	88 576.79	242.68	9.38	830 927	▪ Others
<b>1998</b>	24 485	17 065	287 732	126 779	387 917.86	1 062.79	10.91	4 197 682	From all points
	4 883	3 653	61 148	23 974	73 491.36	201.35	11.39	836 563	▪ From DFPO
	2 300	1 524	30 788	11 933	37 585.16	102.97	11.61	435 691	▪ Muaglek, Saraburi
	1 032	847	14 586	5 862	18 210.35	49.89	11.69	213 125	▪ Prachuap Khiri Khan
	291	290	3 327	1 353	3 685.80	10.1	10.77	40 428	▪ Chiang Mai
	969	736	9 343	3 498	10 230.13	28.03	10.55	107 619	▪ Khon Kaen
	291	256	3 104	1 328	3 779.92	10.36	10.48	39 698	▪ Sukhothai
	15 532	9 951	174 694	80 719	228 879.01	627.07	10.61	2 429 058	▪ Other Co-operatives
	86	82	2 441	713	2 301.93	6.3	10.77	24 752	▪ Educational Institute
	3 984	3 379	49 449	21 373	83 245.56	228.07	10.91	907 308	▪ Others

<b>1999</b>	24 716	17 883	328 008	139 456	442 303.98	1 211.79	11.25	5 008 165	From all points
	5 630	4 271	68 390	27 249	92 786.16	254.21	11.68	1 093 637	▪ From DFPO
	2 546	1 711	30 279	12 623	41 469.45	113.61	11.95	502 980	▪ Muaglek, Saraburi
	1 197	1 063	18 434	7 119	25 466.29	69.77	11.93	305 026	▪ Prachuap Khiri Khan
	647	630	7 563	2 968	9 756.78	26.73	11.29	109 153	▪ Chiang Mai
	926	620	8 751	3 220	11 721.65	32.12	10.84	128 812	▪ Khon Kaen
	314	247	3 363	1 319	4 371.99	11.98	10.71	47 664	▪ Sukhothai
	15 893	10 754	213 019	89 766	260 148.30	712.74	11.04	2 897 152	▪ Other Co-operatives
	85	85	2 242	695	2 742.93	7.51	11.45	31 703	▪ Educational Institute
	3 108	2 773	44 357	21 746	86 626.59	237.33	11.43	985 672	▪ Others

*Source:* Office of Agricultural Economics [www.oae.go.th](http://www.oae.go.th)

The dairy industry has played a part in the restructuring of the Thai agricultural sector that was mentioned in the first section of this report. As an example of the types of changes involving dairying, some farmers in the Central Plains have switched from the growing of rice to the growing of grass for dairy cattle. Dairy farming requires a relatively large capital investment. A cow in the early to mid 1990s cost between Bt15 000 and Bt20 000 (about US\$600 to US\$900 at the exchange rates prevailing then). As well as the capital required to purchase cows, farmers must build pens and convert rice land to grass land (Sectoral Economics Program 1995). Rice farmers who move out of rice growing into dairy farming receive a long term loan from the government backed Bank of Agriculture and Agricultural Cooperatives (BAAC) to buy five dairy cows, repayable in 12 years. The interest rate was 9 percent per year with a seven-year grace period for capital repayment. Additional loans at 9 percent interest were also available to build pens, for land preparation for the growing of animal feed and for water supply development. The grace period for these additional loans was two years. The government guaranteed the price of milk to these farmers. The obligation of farmers was to reduce the area of rice and replace it with grass at the rate of 5 rai of grass per dairy cow.

Farmers raising beef cattle receive similar incentives to those given to dairy farmers. They would not be eligible for additional loans to build pens, but would be eligible for one year loans of about Bt7000 to Bt10 000 each year to be used as working capital in beef raising. The period of eligibility was nine years after four years of participation.

Of Thailand's 74 provinces, in 1993 only two provinces were without dairy farms (Chantalanhaka 1995). The large farms make use of imported Friesian Holstein cows as breeding stock, but "the economic viability of purebred cows for milk production has not been clearly shown ..." (Chantalanhaka 1995, p.5). The Central region of Thailand is where most dairy cattle are to be found, but the region where growth has been the strongest has been the North-eastern region (Figure 3.1).

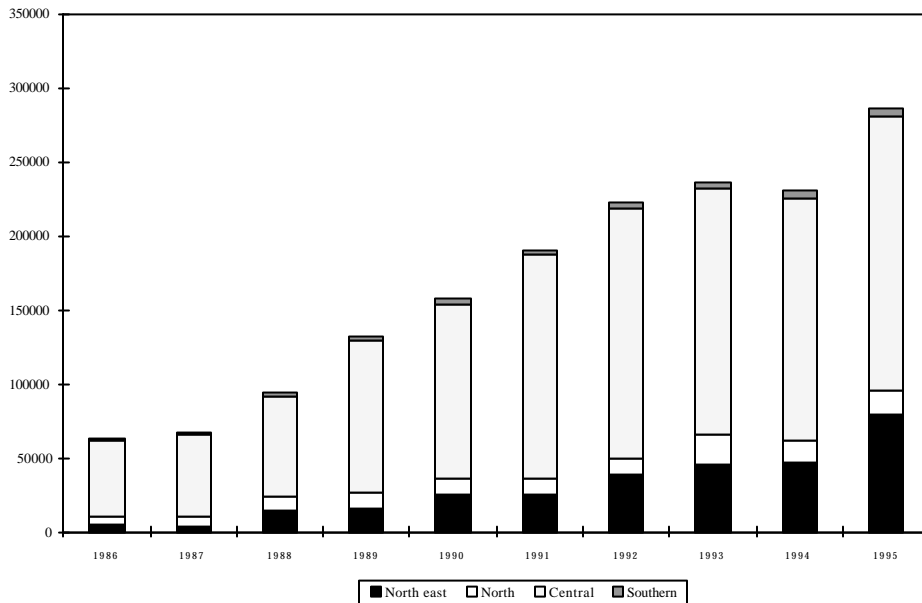
Cows make up over 50 percent of the dairy herd and each produces on average about 10.89 kg of milk per day. Farmers received Bt7.96 per kilogram for milk in 1995, a price almost unchanged in nominal terms since 1993 (Table 3.3). Milk production figures between farmers vary greatly. Suzuki (1997) found from a survey of 12 farmers in the Thaluang Dairy Cooperative<sup>6</sup> that production per cow varied from 8.44 kg per day for the worst farmers to 14.42 kg per day for the best farmers. Surprisingly, in Suzuki's survey there was no decline in daily production in the dry season. Chantalakhana (1995) believes that the high price of land has led to a shortage of forage while employment opportunities away from the farm for the younger generation has led to labour shortages. Chantalakhana (1995) points out that dairy research has been given top priority in Thailand, with major effort being directed towards improving milk yields to between 10 kg and 15 kg per day and reducing calving intervals from an average of 450 to 500 days to 360 to 370 days.

As mentioned earlier and in common with the beef industry, most dairy farms have only a few head of cattle. Over 21 000 dairy cattle were held on farms with less than 2 rai of land and 27 930 dairy cattle were on farms with more than 140 rai. Over one third of dairy cattle were in herds where cattle numbers were between 10 and 20 head

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<sup>6</sup> The Thaluang Dairy Cooperative was established with 50 members in 1990 and membership had grown to 221 by January 1996. This made it a middle-sized cooperative.

**Figure 3.1** Dairy cattle numbers by regions



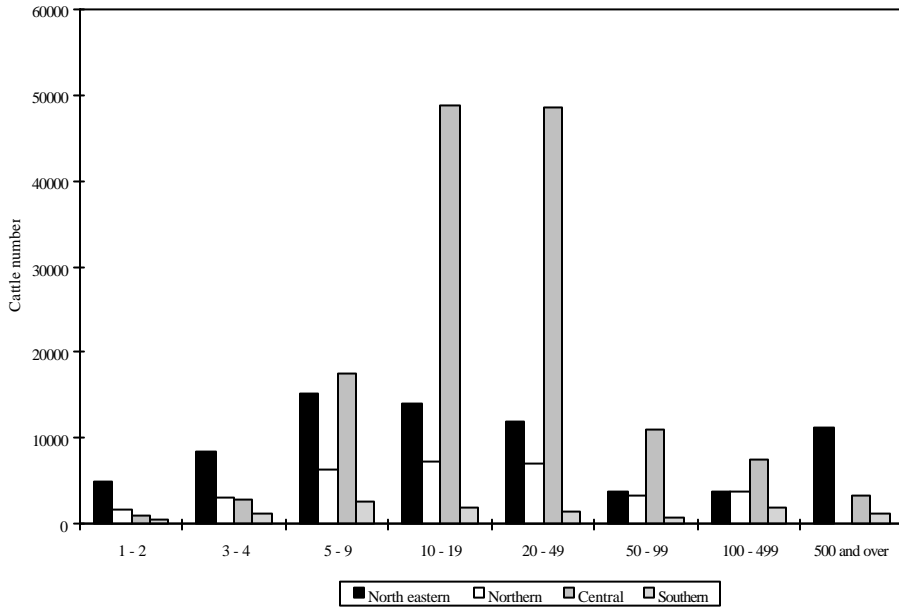
**Table 3.3** Dairy animal numbers, the farmer's milk price and daily milk production

Year	Dairy cattle numbers		Farmer's		Daily milk	
	Calf	Heifer	Cow	Total	milk price (Bt/kg)	production (kg/cow)
1986	12 930	16 318	33 154	62 402	6.55	9.77
1987	14 879	21 024	39 892	75 791	6.59	10.14
1988	18 178	24 886	50 590	93 654	6.62	9.18
1989	22 130	32 249	59 811	114 190	6.65	9.75
1990	26 642	38 744	72 006	137 392	7.01	9.85
1991	33 768	45 370	86 584	165 722	7.12	9.30
1992	40 286	51 312	103 298	194 896	7.51	8.60
1993	45 118	60 989	121 391	227 498	7.98	9.96
1994	49 048	72 772	144 299	226 119	7.96	10.47
1995	54 079	79 517	159 098	292 694	7.96	10.89
1996	44 753	98 165	160 968	303 886	9.07	8.43
1997	53 100	98 651	178 249	330 000	9.39	8.72
1998	64 680	98 620	191 700	355 000	10.66	8.33
1999	75 146	88 662	208 482	372 290	na	na
2000	56 961	125 699	214 430	397 090	na	na

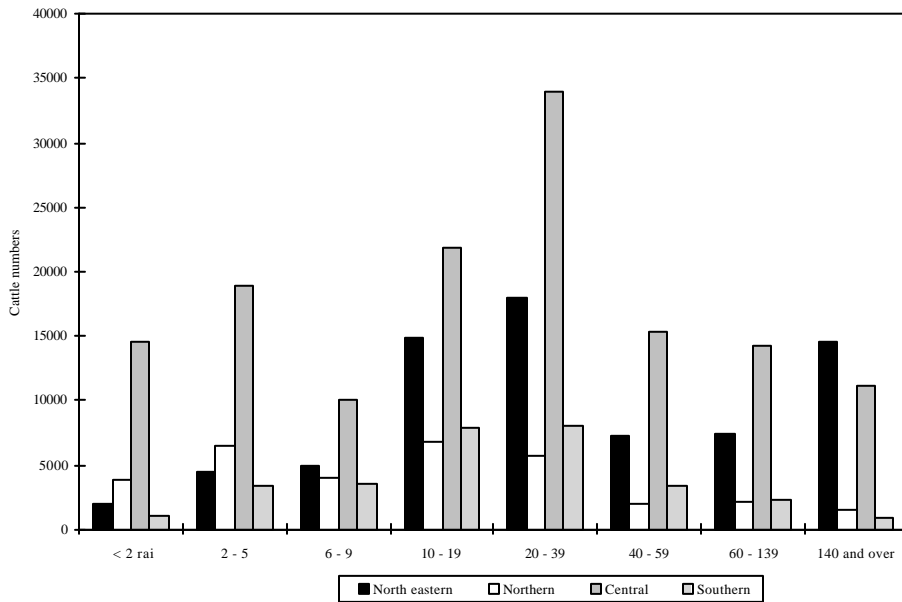
**Note:** Dairy cattle numbers are different from those in Table 3.2 because of different reporting periods. Data from 1966 to 1999 are from Livestock Situation 1998 and Trend of 1999. Data for 2000 are from Livestock Situation 1999 and Trend of 2000

Figure 3.2 and Figure 3.3 show the distribution of dairy cattle according to herd size in the four regions and the distribution by farm area, again in the four regions. Both figures make clear the dominance of small farms in the dairy industry.

**Figure 3.2** Distribution of dairy cattle by herd size and region, 1993



**Figure 3.3** Distribution of dairy cattle by farm area and region, 1993



The dairy industry has a number of problems. Collection and transport costs are high and refrigerated distribution systems are poorly developed (Kehren and Tisdell 1996). Farmers have only limited access to pastures and this can lead to overgrazing and low levels of milk production. Due to the limited availability of pasture as a source of feed, the use of concentrates, industrial by-products and crop residues is of importance. Pichet (1991) argues that improved feed management would lessen the need for concentrates as well as reduce the level of nitrogen fertilizer used. He also says that greater use should be made of agro-industrial by products.

Opinions about the future of the industry vary. On the one hand, Polvatanasug (1995) believes that the industry “will probably not increase greatly over the next few years” (p.28). The reasons for this is that forage is limited and land prices have been increasing. On the other hand, by 2001, the Department of Livestock Development (1996) expected the demand for raw milk would have been 972 210t, which represents an average annual increase of 9.67 percent over the 1994 consumption of 403 933t. On a per person basis, consumption of drinking milk in 1994 was 6.81kg, with most of the consumption occurring in urban or semi-urban areas where marketing facilities, education and income levels serve to facilitate milk consumption. The Thai government introduced a school lunch program in 1994-95 to encourage milk consumption by school children outside urban areas. Its overall objective is to increase consumption to 15 kg per person by 2000 (Chantalakhana 1995).

The Department of Livestock Development has identified problems the Department believes face the industry. These relate to high production costs due to high feed prices; low milk production efficiency due to poor management and poor quality animals; the use of low fat powdered milk to produce drinking milk rather than raw milk because of lower costs; and the poor quality of raw milk. Chantalakhana (1995) believes that the high price of land has led to a shortage of forage while employment opportunities away from the farm for the younger generation has led to labour shortages.

In the Seventh National Plan that ran from 1994 to 1996, the Department of Livestock Development had programs to improve production efficiency. The improvements were achieved through artificial insemination, improvements in animal feeding, animal care and health. The outcome of these projects, according to the Department of Livestock Development (1996) was to increase production from 7 kg per cow per day to 10 kg per cow per day. The number of cows also increased from 165 700 in 1991 to 266 100 in 1994. Milk production overall increased from 193 000 t in 1991 to 326 400 in 1994. As is the case in most developing countries but particularly those where there is a tradition of consuming dairy products, there is an informal milk sector. Franchises have been given to hawkers and small shops to sell bulk pasteurized or boiled milk. There is no reliable public information on the size of the informal sector.

## 4. The poultry industry

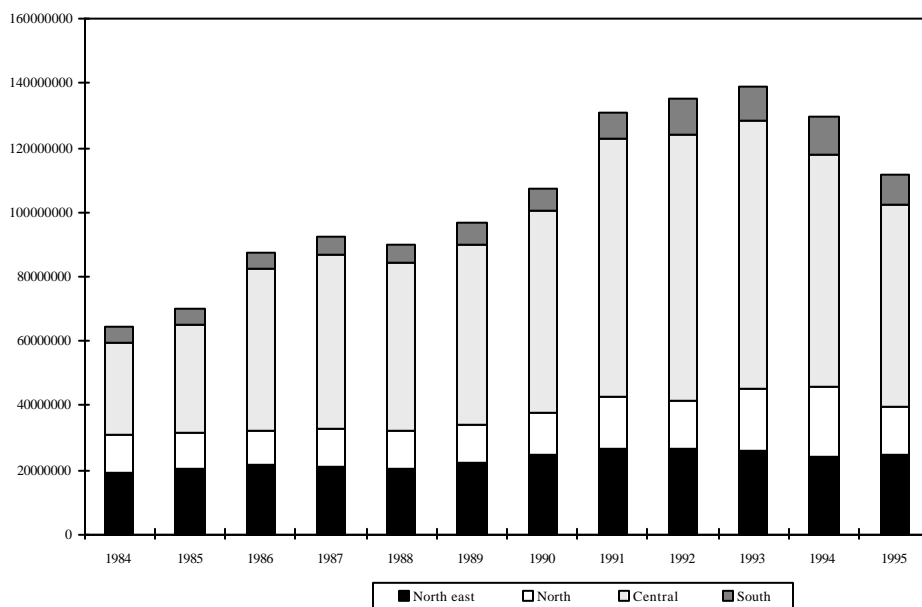
Development of the layer industry began in 1950 at Kasetsart University. However, rapid development only began in the mid-1970s when commercial layer hybrids were introduced from western countries. Modern layer management is used in the industry, and each bird produces 250 to 260 eggs per year (Kanto 1991).

The broiler industry is completely integrated with feedmilling companies and mainly produces for export markets. The view of Siamwalla et al (nd) is that poultry has been the “clear success of Thai livestock production” (p. 7). They attribute this to a number of factors:

- The introduction of modern breed of poultry, particularly for chicken and eggs;
- The use of advanced techniques to raise poultry;
- The pioneering of contract farming by large agribusiness companies in the early 1970s; and
- Low feed prices, reflecting Thailand’s surplus in carbohydrates.

Between 1984 and 1995, chicken numbers increased by about 73 percent overall, with the largest increase in percentage terms occurring in the Central. Here chicken numbers more than doubled between 1984 and 1995 (Figure 4.1).

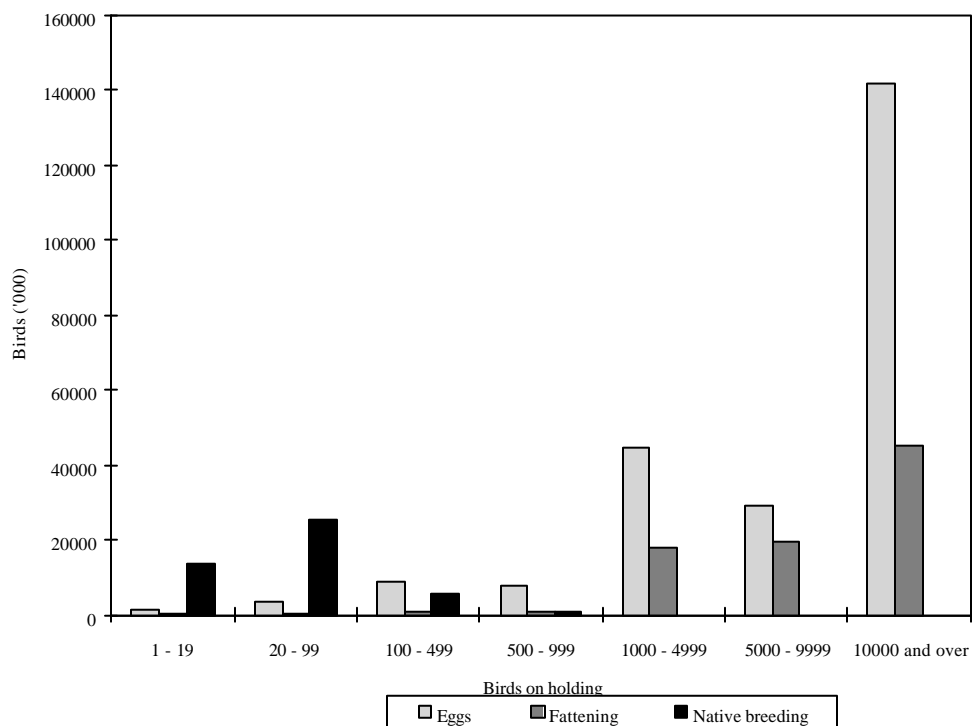
**Figure 4.1** Distribution of chickens by region



Chicken farms are of three broad types (Kehren and Tisdell 1996). First, there are backyard farms where chickens are raised on a small scale for consumption by the farm family or as a source of supplementary income. In the mid-1980s, all but one percent of growers were backyard growers, and they produced about one third of production. By the mid-1990s, they accounted for less than 25 percent of production due to the expansion of commercial farms. Backyard growers provide little if any care to poultry; and consequently losses are high (Noppakun 1998). The second group of farmers are independent commercial growers who often engage in contract growing with smaller growers. The view of Kehren and Tisdell (1996) is that their numbers are likely to decline in the future because

of their inability to benefit from economies of scale attained by the large commercial growers. The third group of growers are contract growers. They became important in the late 1970s when the Charoen Pokphand Company<sup>7</sup> introduced wage and price guaranteed contracts between chicken growers and hatcheries and feed companies. Large multinational companies now dominate the industry. Kehren and Tisdell (1996) report for example that 10 to 12 companies control about 80 percent of broiler production. Figure 4.2 shows the small farms tend to be involved mainly with the breeding of native birds while the large farms with over 10 000 birds tend to be involved in egg productions. Obviously most poultry are found on large farms. For example, about 140 million birds used for producing eggs were on farms with 10000 birds or more. Most of the broilers used to produce chicken meat are on the large farms.

**Figure 4.2** Distribution of birds according to the numbers of birds per holding and the type of activity, Thailand 1995



Sornnuwat (1994) points out that in the past, chicken meat was limited to the high income groups because it was relatively expensive. Real poultry prices have been in decline, resulting in poultry becoming more important in the Thai diet at the expense of other meats, including fish, buffalo and beef and pork. The chicken meat sold domestically can be in the form of the whole carcass or parts, such as head, neck, wings and breast meat. Some is bone-in and some is deboned. There is also further processing of poultry meat into chicken sausage, chicken ball and partly cooked products ready for reheating. Consumption of poultry was about 6.6 kg per person in the late 1980s and almost double this level a decade later.

<sup>7</sup> The Charoen Pokphand Group (CP) is a large multinational company with interests ranging from feed milling to poultry production to restaurants and petrol stations. It has 80 000 to 100 000 employees and a turnover in recent years of the order of US\$8 billion.

Thailand has had success in exporting poultry, principally to Japan. Recently its share of the Japanese market has been pressured by exports from the United States, Brazil and China. Under World Trade Organisation rules, subsidies on broiler production will be phased out. Thai officials believe that since the Thai industry receives little in the form of subsidies, it should be able to gain a competitive advantage on international markets. Not everyone agrees with this. There are some who say that Thailand's competitive edge is beginning to be lost to neighboring countries such as Vietnam and China because of rising wage rates in Thailand. The industry faces additional difficulties, including the following:

- Parent stock and grand parent stock have to be imported causing high production costs;
- Some feed stuffs used in the industry need to be imported. The significance of this is that feed represents about 70 percent to 75 percent of total production costs; and
- Newcastle disease is a problem for exporters since most countries importing poultry require imports to be free of this disease.

**Table 4.1** Production, consumption and exports of poultry from Thailand

Year	Production		Consumption		Exports		
	(mill. birds)	(000 t)	(mill. birds)	(000 t)	(mill. birds)	(000 t)	(mill. Bt)
1981	340.4	385.3	292.7	358.5	47.7	26.7	1 186.6
1982	416.9	471.8	357.6	438.6	59.2	33.2	1 310.0
1983	418.6	473.7	377.7	450.8	40.9	22.9	946.4
1984	430.9	487.7	369.9	453.5	61.0	34.2	1 419.7
1985	488.2	552.5	420.7	514.7	67.5	37.8	1 468.1
1986	504.2	570.7	388.7	505.9	115.5	64.8	3 121.3
1987	446.3	505.1	300.3	423.2	146.0	81.9	4 019.9
1988	458.1	518.5	287.3	422.7	170.7	95.8	4 869.9
1989	551.6	624.4	359.0	516.3	192.7	108.1	5 883.7
1990	488.5	552.9	240.8	413.9	247.7	138.9	7 589.7
1991	568.0	642.9	275.3	478.7	292.6	164.2	10 275.7
1992	725.6	821.3	414.0	646.5	311.6	174.8	10 399.3
1993	710.6	804.3	430.6	647.2	280.0	157.1	8 884.5
1994	646.5	731.8	373.7	578.7	272.8	153.0	9 854.4
1995	664.3	751.9	396.4	601.5	267.9	150.3	9 688.4
1996	684.0	774.2	381.0	604.2	303.0	170.0	12 000.0

**Notes:** The average broiler weight is 1.8 kg; the percentage of meat per broiler is 62.88 percent; and the weight exported per bird is 0.561 kg.

**Source:** Department of Livestock Development (1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

**Table 4.2** The quantity and value of exported frozen broiler meat, 1993 to 1999

Country	1993		1994		1995		1996	
	(t)	(mill Bt).	(t)	(mill. Bt)	(t)	(mill. Bt)	(t)	(mill. Bt)
<b>Total</b>	<b>156879.30</b>	<b>9394.80</b>	<b>160162.50</b>	<b>10374.50</b>	<b>168004.70</b>	<b>10597.90</b>	<b>126520.60</b>	<b>8457.50</b>
Japan	126404.40	7440.00	130789.60	8356.80	137029.50	8697.50	98364.10	6589.40
Germany	10177.20	956.10	10538.10	1023.10	8399.30	721.40	9546.50	776.20
Singapore	4464.40	223.10	5268.10	282.70	5547.70	320.20	3166.80	188.00
Hong Kong	4400.10	95.10	3385.40	89.70	3769.50	122.00	828.20	26.60
Netherland	3636.30	291.30	3037.40	306.10	3237.10	264.60	5524.90	384.20
Republic of China	3095.30	93.80	2877.50	72.40	2749.80	65.90	999.10	20.10
Africa	678.60	36.20	2328.30	131.10	1742.20	104.00	46.00	0.50
Kuwait	1188.10	67.00	396.80	21.50	890.90	51.90	471.80	28.30
Switzerland	422.50	23.50	457.00	29.20	689.60	41.30	107.90	9.70
United Arab Emirate	598.80	31.20	152.90	9.30	573.60	34.80	23.00	1.40
Saudi Arabia	160.80	7.70	210.80	11.70	529.80	32.30	46.00	2.70
England	-	-	-	-	-	-	4086.80	277.00
Malaysia	-	-	-	-	-	-	1845.90	106.40
Others	1652.80	129.80	720.60	40.90	2,845.70	142.00	1463.60	47.00

Country	1997		1998		1999	
	(t)	(mill Bt)	(t)	(mill. Bt)	(t)on	(mill. Bt)
<b>Total</b>	<b>148724.67</b>	<b>10945.76</b>	<b>208880.56</b>	<b>16973.76</b>	<b>222972.90</b>	<b>16386.70</b>
Japan	101314.13	7290.42	132860.54	10987.53	136556.48	10398.13
Germany	13524.04	1227.16	23777.71	2346.72	27755.69	2263.04
Singapore	5237.95	339.24	6666.11	493.23	9856.28	644.48
Hong Kong	1686.43	75.80	4209.81	159.10	5261.34	183.18
Netherland	12995.43	1085.02	15617.58	1339.74	14820.99	1052.26
Republic of China	2057.17	54.92	8365.16	230.21	4,954.66	124.07
Africa	-	-	242.85	12.77	-	-
Kuwait	598.81	38.22	1,047.75	81.37	781.80	57.08
Switzerland	-	-	45.98	5.09	-	-
United Arab Emirate	78.65	7.13	347.03	32.12	12.00	0.84
Saudi Arabia	22.98	1.75	116.98	13.78	46.99	5.13
England	3326.85	296.21	7,315.59	642.44	11287.98	913.84
Malaysia	2328.59	148.35	2,487.37	166.77	3316.64	158.18
Others	5553.64	381.54	5,780.10	462.89	8,322.05	586.47

**Source:** Department of Livestock Development(1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

Ducks are of some importance but mainly for the small farmers who use them for pest control, for home consumption and as an income supplement. The data in Table 4.3 show that duck numbers have been almost unchanged since the mid-1980s.

**Table 4.3** Numbers of ducks in Thailand

Year	Central	North east	North	South	Total
1984	11 010 101	5 211 993	1 490 041	1 247 320	18 959 455
1985	10 957 388	5 383 053	1 557 609	1 500 211	19 398 261
1986	10 695 982	6 383 894	1 564 203	1 322 198	19 966 277
1987	9 580 908	7 321 415	1 649 665	1 279 043	19 831 031
1988	7 590 049	5 873 440	1 261 188	1 209 757	15 934 434
1989	8 609 346	5 225 727	1 553 434	1 294 869	16 683 376
1990	9 614 972	5 347 301	1 545 945	1 393 622	17 901 840
1991	10 398 969	5 934 037	1 416 574	1 373 984	19 123 564
1992	10 288 432	6 019 511	1 334 457	1 702 414	19 344 814
1993	11 742 093	6 420 269	1 821 108	1 794 925	21 778 395
1994	12 636 861	5 888 475	1 408 325	1 878 154	21 811 815
1995	10 564 520	5 118 910	1 431 412	1 781 793	18 896 635
1996	11 951 646	5 933 781	1 836 174	2 203 036	21 924 637
1997	11 470 759	6 027 409	2 176 228	2 155 500	21 829 896
1998	10 769 738	5 261 088	1 778 786	1 938 465	19 748 077
1999	13 863 676	4 695 818	2 271 464	1 499 165	22 330 123
1999/1986	1.26	0.90	1.52	1.20	1.17

**Source:** Department of Livestock Development (1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

Table 4.4 shows how government officials in the Department of Livestock Development (DLD) hoped the industry would have developed by 2001. The number of broilers in Thailand was expected to increase almost four fold to 2 753 million birds, from the 1997 level of 672 million. Domestic consumption of broiler meat was expected to increase more than 10 times between 1997 and 2001. Native chickens were forecast to provide an increased quantity of meat per person (from 5 kg per person in 1997 to 12.5 kg per person by 2001). This is despite the large expected increase in the broiler industry. About 234 767 t (equivalent to about 754 million broilers) were expected to be exported. With regard to egg production, the DLD predicted that approximately 12.6 billion eggs would be produced and that about 75 percent of these would be consumed locally. Domestic consumption of eggs was expected to climb to 155 eggs per person each year, about 55 percent above the 1997 level. At the time of preparing this report, publicly available information was not available to judge whether these goals had been reached.

**Table 4.4** Features of the poultry industry, 1997 versus 2001

<b>Item</b>	<b>Unit</b>	<b>1997</b>	<b>2001</b>
<b>Broilers</b>			
• Broiler numbers	000	672 000	2 753 354
• Consumption of broiler meat	Kt	59.4	622.9
• Exports of broiler meat	Kt	150.0	234.8
<b>Hen eggs</b>			
• Layer hen numbers	000	24 727	Na
• Egg production	mill. eggs	9 000	12 600
• Egg exports	mill.eggs	3 000	3 300
• Per person annual consumption of eggs	no.	100	155
<b>Native chicken</b>			
• Number of parents	000	6 000	15 000
• Number of chickens	mill.	300	750
• Domestic consumption	Kt	300	750
• Per person annual consumption of native chicken meat	Kg	5	12.5
<b>Duck meat</b>			
• Domestic consumption	000 birds	10 175	2 120
• Domestic consumption	Kt	11	24
• Meat exports	Kt	15	15
• Per person annual consumption of duck meat	kg	0.2	0.4
<b>Duck eggs</b>			
• Domestic production	mill. eggs	13	60.2
• Domestic consumption	mill. eggs	12.8	60
• Per person annual consumption of duck eggs	no.	0.2	1

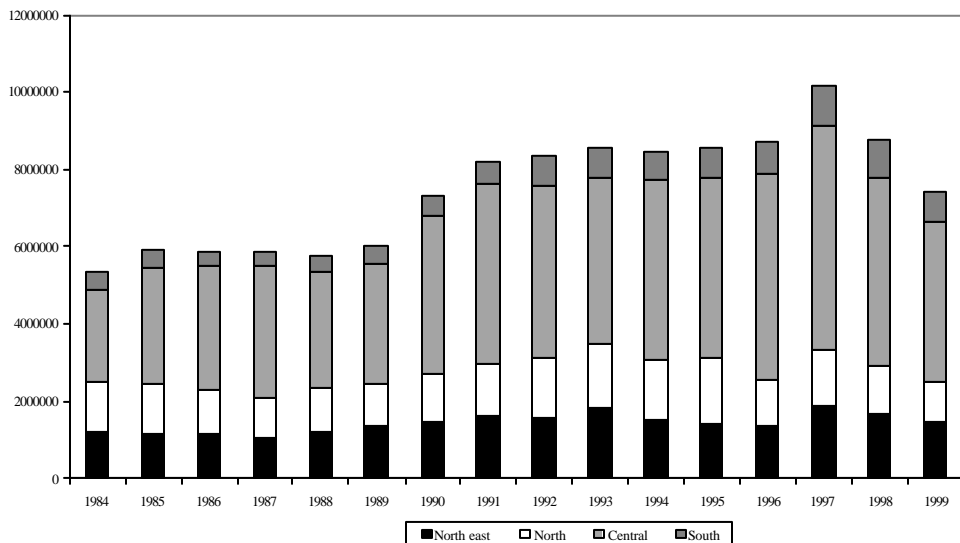
## 5. The swine industry

Pork has become the second most important meat in Thai consumption, with average consumption in the late 1990s of about 4.7 kg per person per year. This consumption would have been much higher were it not for the government's restrictive policies towards the slaughtering industry in the view of Siamwalla, Setboonsarng and Patamasiriwat (nd). They point out that the restrictions on the slaughtering industry also has disadvantaged the beef industry.

Development of pig production started in 1960 when the first group of exotic pig breeds were imported by the Department of Livestock Development from the United Kingdom. These were Large Whites, Tamworth and Berkshire breeds. Later, Landrace and Duroc Jersey breed pigs were imported from the United States. Up until these exotic breeds were introduced, farmers relied on the relatively slow growing native pigs that had the desirable quality of not needing much in the way of traded inputs. The imported pigs were used for breeding improvement and were cross bred with the native pigs (Kanto 1991). Throughout the 1960s and 1970, crossbred pigs were raised by backyard producers for consumption by the farm family and also as a source of income. Kehren and Tisdell (1996) point out that while pigs generated the largest value added in the livestock sector in 1975, the virtual stagnation of the industry up through the 1980s was to a large degree due to government intervention that discouraged private investment in the pig industry.

Sornnuwat (1994) says that swine production in Thailand follows a cycle, determined by the pig price. This can lead to boom-bust cycles of the type that occurred in the early 1980s. As a result of an oversupply of pigs in 1984 and 1985, pig raisers suffered heavy losses (Sornnuwat 1994). Heavy losses were expected again in 1987 had it not been for an outbreak of swine disease in the Central , Thailand's main producing region (Table 5.1). This region has about 50 percent of Thailand's pig population. The Southern has the smallest number of pigs, possibly reflecting the higher cost of pig fattening because of a shortage of feed in this region. An alternate explanation could be that the southern part of Thailand has a relatively high Muslim population for whom consuming pork is prohibited. Most of the pork produced in Thailand is consumed domestically because of the presence of foot and mouth disease in some of the producing areas in Thailand. Export markets are limited to Hong Kong, Vietnam and Singapore. Finished (processed) pigmeat based products are more widely exported. Most of the industry's output comes from small or medium sized farms as these dominate the industry (Table 5.1). According to Kanto (1991), modern swine feeding and management systems from western countries have been accepted by farmers.

**Figure 5.1** Distribution of pigs by regions



**Table 5.1** Numbers of holdings rearing swine, Thailand 1993

Swine per holding	Holdings		Swine	
	Number	Percent	Number	Percent
1 - 2	286866	48.57	423119	6.84
3 - 4	86483	14.64	289120	4.67
5 - 9	98163	16.62	630927	10.20
10 - 19	71585	12.12	898307	14.52
20 - 49	34578	5.85	932947	15.08
50 - 99	6853	1.16	418215	6.76
100 - 499	5043	0.85	894132	14.45
500 and over	1045	0.18	1693213	27.37
<b>Total</b>	<b>590616</b>	<b>100.00</b>	<b>6185953</b>	<b>100.00</b>

*Source:* National Statistics Office (1996a, 1996b, 1996c, 1996d)

Up until the mid 1980s, small intermediaries who were often the agents of large wholesalers collected their pig requirements by travelling from village to village, and then delivering the pigs to slaughterhouses. Some of the slaughterhouses were operating illegally (Kehren and Tisdell 1996). In recent years, the development of commercial pig raising farms has seen the role of the small intermediaries diminish in importance. Contract growing of pigs takes place with feed milling companies providing piglets, animal feed, veterinary services and farm management skills to contracted pig growers. This has opened the way for Thailand to increase exports of pork to other countries in the Asia Pacific region (Kehren and Tisdell 1996).

## 6. Prices of livestock and livestock products

Information on the nominal prices of livestock and livestock products is contained in Tables 6.1 to Table 6.5. The data give some indication of the price spread between the wholesale price and the farm gate price. It appears that the price spread for beef is wide relative to that for poultry and pig meat. This may be a disincentive for small farmers to become involved in beef cattle production.

**Table 6.1** Beef cattle prices, Bangkok

Year	Farmgate price of live cattle	Wholesale price of live cattle	Wholesale price of beef	Retail price of sirloin beef	Retail price of tenderloin
	(Bt/kg)	(Bt/kg)	(Bt/kg)	(Bt/kg)	(Bt/kg)
1978	10.12	13.24	19.96	29.54	
1979	10.65	15.57	21.41	33.18	
1980	14.69	17.86	23.73	48.81	
1981	17.77	26.92	38.94	55.67	
1982	17.76	27.5	39.49	56.72	
1983	18.29	27.35	39.50	56.44	
1984	18.25	27.29	39.17	56.7	
1985	20.41	27.68	39.33	56.7	
1986	21.19	28.1	38.95	56.3	
1987	20.93	28.12	38.59	53.21	
1988	24.23	32.24	40.79	57.47	
1989	23.51	36.12	45.62	63.57	101.91
1990	25.07	34.74	44.69	66.15	108.44
1991	25.78	39.81	48	67.92	112.97
1992	25.97	45.53	52.38	70.12	114.29
1993	24.19	45.53	52.44	71.21	114.5
1994	24.26	42.5	52.5	71.35	115.44
1995	24.26	42.5	52.5	71.35	119.08
1996	23.99			72.42	119.89
1997	7 443/head	-	-	92.36	133.97
1998	7 746/head	-	-	99.19	138.98
1999	9 278/head	-	-	107.55	148.07

**Source:** Office of Agricultural Economics. Data from 1967 to 1998 are from Livestock Situation 1998 and Trend of 1999. Data for 1999 are from Livestock Situation 1999 and Trend of 2000.

**Table 6.2** Poultry inventory and farm price

Year	Number on farms January 1			Farm Price			
	Chicken	Duck	Geese	Live Chicken	Live Duck	Chicken eggs	Duck eggs
	(000)	(000)	(000)	(Bt/kg)	(Bt/kg)	(Bt/1000)	(Bt/1000)
1988	93 134	15 934	642	19.49	24.21	1,250.00	1,490
1989	102 343	16 683	427	20.66	35.16	1,280	1,550
1990	117 647	17 902	519	23.12	37.74	1,380	1,620
1991	126 609	19 124	536	22.44	32.04	1,370	1,630
1992	137 386	19 345	440	22.02	31.23	1,300	1,540
1993	139 085	21 778	548	22.85	32.54	1,400	1,620
1994	147 092	21 812	460	25.19	37.16	1,420	1,660
1995	148 784	18 897	413	27.96	33.92	1,470	1,710
1996	160 789	21 400	-	26.79	41.47	1,610	1,870
1997	172 284	21 830	-	27.66	39.71	1,550	1,830

**Table 6.3** Price of pigs at the farm and at the Bangkok wholesale market

Year	Farm price	Wholesale market price
	(Baht/kg)	(Baht/kg)
1986	19.15	21.00
1987	22.11	23.80
1988	25.96	27.35
1989	28.17	29.43
1990	24.92	26.37
1991	30.00	30.31
1992	31.31	32.85
1993	23.75	25.53
1994	26.76	28.49
1995	36.07	37.08
1996	39.60	
1997	38.70	
1998	37.49	
1999	42.40	
2000	33.89	
2001	31.48	

**Source:** 1986-95 data came from Agricultural Economics Division, Department of Economics and Trade. Data for 1996-2001 were obtained from [www.oae.go.th](http://www.oae.go.th)

**Table 6.4** Price of broilers at the farm and the wholesale Bangkok market

Year	Farm price	Wholesale price
	(Baht/kg)	(Baht/kg)
1986	18.47	19.16
1987	18.61	19.88
1988	18.46	19.75
1989	20.39	21.53
1990	22.20	23.10
1991	22.65	24.09
1992	19.09	20.48
1993	21.19	22.67
1994	23.49	25.19
1995	25.48	26.84
1996	26.79	na
1997	27.66	na
1998	32.06	na
1999	28.67	na
2000	26.27	na
2001	27.57	na

*Source:* Agricultural Economics Division, Department of Economics and Trade for data up to 1995. Data for 1996 to 2001 were obtained from [www.oae.go.th](http://www.oae.go.th)

**Table 6.5** Price of day old broiler chick and price of day old layer chick

Year	Broiler	Layer
	(Bt)	(Bt)
1991	8.31	10.62
1992	3.60	12.12
1993	6.29	10.03
1994	7.79	14.41
1995	10.08	15.42
1996	6.58	13.42
1997	9.17	8.38
1998	9.25	12.19
1999	8.65	17.92

*Source:* Data for 1996 to 1998 are from Livestock Situation 1998 and Trend of 1999. Data for 1999 are from Livestock Situation 1999 and Trend of 2000

**Table 6.6** Price of chicken egg at the farm and the Bangkok wholesale market

Year	Farm price	Wholesale price
	(Bt/egg)	(Bt/egg)
1986	1.01	1.00
1987	1.02	0.99
1988	1.21	1.35
1989	1.25	1.39
1990	1.40	1.50
1991	1.35	1.45
1992	1.26	1.36
1993	1.36	1.40
1994	1.37	1.42
1995	1.43	1.48
1996	1.61	na
1997	1.55	na
1998	1.83	na
1999	1.79	na
2000	1.42	na
2001	1.43	na

*Source:* Department of Economics and Trade for years up to 1995. Data from 1996 to 2001 are from [www.oae.go.th](http://www.oae.go.th)

**Table 6.7** Price of mixed rations for different livestock

Year	Pigs	Laying hens	Laying ducks
	(Baht/kg)	(Baht/kg)	(Baht/kg)
1991	5.20	5.16	4.92
1992	5.48	5.46	4.44
1993	5.29	5.14	4.55
1994	5.52	5.38	4.92
1995	6.62	5.88	5.88

*Source:* Department of Economics and Trade

## 7. The animal feed industry and livestock performance

Thailand has a surplus in energy feeds but a deficit in protein feeds. As is the case for cattle, which have been promoted by the government in restructuring of agricultural production systems, a shortage of hay and pasture for feeding dairy cattle in the dry season is a problem that is expected to be exacerbated as the number of dairy cattle expands (Sectoral Economics Program 1995). Rice straw, the main roughage used during the dry season, is of low quality resulting in a loss in condition by animals receiving rice straw as the sole nutrient. In the early 1980s, about 23 million tonnes of rice straw was available for animal feed (Srisunt 1991). Agro-industrial by-products are an important source of feed for ruminants. Pineapple waste silage and leaves from baby-corn canning factories have been used for cattle fattening and on dairy farms. Water scarcity is a problem for the livestock sector. Farmers do not pay for surface water hence there is no incentive for farmer to use it efficiently. The livestock industries have experienced problems obtaining water for animals to drink, for the cleaning of animals and their pens and for cooling pigs in the summer when it is hot and dry.

The Thai government reduced the import duty on soybean meal from 10 percent to 5 percent in May 1997 in a bid to help lower production costs for meat producers. It was hoped that through the lowering of these costs, that the competitiveness of Thailand's meat exporters in international markets would be improved. The government has other regulations designed to assist Thailand's soybean producers. One of these required that feedmilling companies, meat producers and vegetable oil refineries buy soybeans in the late 1990s at Bt 8.50 per kg at the factory, or at Bt 8 per kg at the farm.

**Table 7.1** Wholesale price of animal feed at the Bangkok market, in Baht per kg

Item	Fine rice bran	Coarse rice bran	Defatted rice bran	Soybean meal (imported)	Soybean meal (Thai)	Corn meal	Fish meal <sup>(a)</sup>	Fish meal <sup>(b)</sup>
1991	3.41	0.93	3.29	7.82	8.64	3.42	14.37	14.21
1992	3.46	0.53	3.18	8.09	8.89	3.90	14.35	14.35
1993	3.54	0.61	3.33	8.04	8.82	3.35	14.26	14.26
1994	3.65	0.87	3.34	7.67	8.82	3.75	13.82	13.82
1995	3.31	0.64	3.02	7.92	8.58	4.98	14.46	14.46
1996	4.08	0.88	3.97	9.74	9.88	5.16	15.87	15.87
1997	5.01	0.95	4.95	9.91	10.62	4.51	17.21	17.21
1998	10.24	10.57	9.30	7.69	8.64	5.42	10.02	10.02
1999	3.47	1.04	2.86	7.44	9.88	4.64	16.32	

**Notes:** <sup>(a)</sup> 58 percent to 62.9 percent protein; <sup>(b)</sup> 55 percent to 57.9 percent protein.

**Source:** Department of Economics and Trade. Data from 1966 to 1998 are from Livestock Situation 1998 and Trend of 1999. Data for 1999 are from Livestock Situation 1999 and Trend of 2000

In the dairy industry, most farmers use mixed feed as a concentrate. This feed is produced in Thailand by large private companies and then distributed by the dairy cooperatives. With regard to the amount of concentrate used, a general rule of thumb seems to be that farmers gives each cow an amount equal to half the quantity of milk produced per milking cow. The quality of the feed is sometimes uncertain as it is low in energy and protein. This makes it difficult for animals to recover condition after calving. With regard to roughage, systematic data are not available. However, the feeding of 30 kg to 40 kg of fresh roughage (stems and leaves) during the rainy season and unlimited amounts of rice straw during the dry season seems to be a common practice. Other roughage fed to the animals includes sugar cane tops, and the dried stems and leaves of peanuts and soybean. It is likely that roughage requirements of many farms with dairy cattle are inadequate during the dry season. The important role played by rice as a source of feed means that farmers with ruminants are likely to select rice varieties for the foliage material that is produced by the plant, not just the quantity of grain that the plant yields.

As noted earlier in this paper, producers in the pig industry follow modern western-style practices. While the commercial feedmills produce pellet sized broiler feeds and protein supplements, there is a wide range of on-farm feed produced. Kanto (1991) reports that “more than 70 percent of pig farmers in the country have adopted on-farm feed production ...” (p.343). This seems to have been successful as supervision by premix companies ensures that the feeds used by these farmers are competitive with those used by farmers in the feedmill integrated system. Piglets are weaned at 28 days and require another 140 to 150 days to reach the market weight of approximately 100 to 105 kg. Average performance for the industry is shown in Table 7.2.

**Table 7.2** Performance of the pig industry

Growing - Finishing			Breeding	
Average daily gain	g/day	650 - 700	Number of litters per year	2 - 2.2
Feed conversion ratio		2.6 - 3.0	Number of piglets per sow per year	18
Lean content	percent	45 - 50	Number of parturitions allowed	6 - 7

*Source:* Kanto (1991), p.343

In the broiler industry, birds reach an average weight of 1.8 to 2.0 kg within seven weeks with a feed conversion ratio of 2 to 2.2, depending on the feed mixture. The birds are fed commercially produced pelleted rations. In the early 1990s, this form of feed represented about 90 percent of the total feed used in the broiler industry (Kanto 1991). Different diets have to be used during hot weather as high-energy rations have led to high mortality rates.

Broken rice (a by-product of the rice milling process) and corn are the most popular base ingredients for the poultry industry and the pig industry. Rice bran makes up no more than 30 percent of pig finishing rations because of its bulk. Corn produced in tropical countries such as Thailand is susceptible to bacterial contamination when there is moisture in the atmosphere. Hence, corn has to be dried to approximately 13 percent moisture as soon as possible following harvest (Kanto 1991). Sorghum and cassava are being progressively accepted as substitutes for pig and poultry rations. The main protein supplements used in the pig and poultry industries are soybean meal and fishmeal. Peanut meal, sunflower meal and sesame seed are generally used as substitutes.

## 8. Government policy

It is difficult to obtain details of government intervention in the livestock sector. A comprehensive study was carried out in 1989 by a team sponsored by the Asian Development Bank, but since then there appears to have been little analysis and/or discussion of livestock policies. According to Burch (1996), the state played only a minor role in agricultural development in Thailand. In the pre-war period, state investment was directed at railways in preference to irrigation. While rice remained the cornerstone of the agricultural sector<sup>8</sup>, diversification began in the early 1960s, with farmers starting to cultivate cassava and maize. Burch, citing Krongkaew (1995), points out that the first National Economic and Social Development Plan (produced for 1961-66) shifted the emphasis to some degree with the state providing support for infrastructure development while leaving the major role for investment in productive facilities to the private sector. Farmers received support from the Bank of Agriculture and Agricultural Cooperatives (BAAC) and the agro-processing sector from the Board of Industrial Promotion (superseded by the Board of Investments in 1977). Burch argues that Thailand's agricultural sector was grossly undercapitalised, with 14 percent of the cultivated area being irrigated and only 4 percent of the rice area being double cropped. A second wave of diversification began in the early 1970s, and it was based upon the production of a wide variety of value added and semi-processed foodstuffs. There was also extensive state involvement (Burch 1996).

That there is relatively little information available on intervention in Thailand's livestock industries is not surprising. These industries, with the exception of the poultry industry and the pig meat industry, have been a relatively minor part of Thailand's agricultural sector. Burch (1996) provides information on government policies and the agro-processing industries. He explains how the Fourth Economic and Social Development Plan (covering 1977 to 1981) indicated the government should encourage industrialisation concurrently with agricultural development and give support to basic industries, supporting industries and agro-industries. Incentives have taken the form of guarantees against nationalization and competition from state enterprises; protection from import competition, and tax exemptions and deductions for exporters. The Board of Investments offered incentives designed to encourage industry to locate in rural areas outside of the Central Plains region.

- With few exceptions, project located in Bangkok and five of the surrounding provinces (Zone 1) were not entitled to tax exemptions on machinery and corporate income
- Projects located in 10 provinces a little further out from Bangkok (Zone 2) were entitled to a 50 percent reduction on machinery. A full tax exemption on machinery and corporate tax exemptions was awarded to firms in agro-based activities and/or using domestic raw materials for at least 60 percent of total raw materials.
- Thailand's remaining 57 provinces were designated as Special Investment Zones. Agro-based activities receive special support, which means that the sector is entitled to tax exemptions on machinery, 50 percent reduction of import duty and business tax on raw or essential materials used in production for the domestic market for one year. This was extended to five years if the goods produced were for exports. Firms also were exempt from corporate tax for eight years. Other promotional benefits are outlined in Burch (1996).

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<sup>8</sup> In the 1960s, the two main taxes on rice - the rice premium and the rice export tax - provided 20 percent of government revenue. The rice premium was zero rated in 1986 and the export tax was abolished in 1990 (Burch 1996).

**Table 8.1** Tariff rates on meat products, Thailand

<b>Tariff item</b>	<b>Existing tariff</b>	<b>GATT base tariff</b>	<b>GATT bound tariff</b>	<b>Reduction</b>	<b>Period</b>
	(%)	(%)	(%)	(%)	
<b>Meat of bovine animal fresh, chilled or frozen</b>					
• Bone in	60	60	50	16.6	1995-2004
• Boneless	60	60	50	16.6	
• Carcass	60	60	50	16.6	
<b>Meat of sheep, lamb or goats, fresh, chilled or frozen</b>					
• Lamb	60	50	30	40	
• Sheep	60	50	30	40	
• Carcass	60	50	30	40	
• Bone in	60	50	30	40	
• Boneless	60	50	30	40	
• Goat	60	50	30	40	
<b>Edible offal of bovine animals, sheep or goats, fresh, chilled or frozen</b>					
• of bovine animals	60	60	30	50	
• of sheep or goats	60	60	30	50	
<b>Sausages &amp; similar products, of meat, meat offal or blood; food preparations based on these products</b>					
• homogenised preparations	60	60.5 baht/kg	40.34 baht/kg	33.3	
• of liver of any animals	60	60.5 baht/kg	40.34 baht/kg	33.3	
• of bovine animals	60	60.5 baht/kg	40.34 baht/kg	33.3	
• other, including preparations of blood of any animal	60	60.5 baht/kg	50.42 baht/kg	16.6	
<b>Whole hides &amp; skins of bovine animals, sheep or goats, fresh wet-salted or otherwise preserved</b>					
• of bovine animals	60	30	27	10	
• of sheep or goats	60	30	27	10	
<b>Live bovine animals</b>					
• pure bred breeding animals	free	free	free	na	
• for slaughter	60	40	30	25	
<b>Live sheep or goats</b>					
• pure bred breeding animals	free	free	free	na	
• for slaughter	60	40	30	25	

Burch (1996) goes on to explain that the Board of Investments sets out rules regarding the capital used in industry, including those industries that are agro-based.

- If production is mainly for the domestic market, Thai nationals must own 51 percent of the equity.
- If the venture is in agriculture, animal husbandry, fisheries, mineral exploration, mining or services, Thai nationals must own 60 percent of the equity.
- If 50 percent of the output was exported, foreigners may own the majority of shares.
- If 100 percent of the output is exported, foreigners may own 100 percent of the shares.

Board of Investment data obtained by Burch are presented in Table 7.2.

Investment applications submitted from 1 August 2000 are subject to revised regulations (Investment 2001). Priority activities are as follows.

- Agriculture and agricultural products. This includes animal breeding, animal husbandry, feed manufacture, slaughtering, the manufacture of food made from animals and the manufacture of products from raw milk.
- Technological and human resource development.
- Public utilities and infrastructure.
- Environmental protection and conservation.
- Targetted industries.

Unlike the earlier policy, corporate tax exemption and exemption from import duty on machinery is provided, regardless of location. There are a number of other privileges according to zone. Investments in Zone 1, made up of Bangkok and five provinces, receive the following benefits:

- 50 percent reduction of import duty on machinery subject to an import duty of not less than 10 per cent;
- Exemption for one year of import duty on raw or essential materials used in the manufacture of export products; and
- Corporate income tax exemptions for three years for projects in industrial estates or promoted industrial zones, provided that the capital invested is Bht 10 million or more and that ISO 9000 or similar international certification is obtained within two years. Otherwise, the corporate income tax exemption is reduced by one year.

Projects in Zone 2, made up of 12 provinces, have similar (but more generous) benefits and projects in Zone 3 (made up of the remaining 58 provinces) are treated even more generously. For example, Zone 3 projects are exempted from import duty on machinery, and corporate tax exemptions are available for up to eight years, subject to the project satisfying certain conditions laid out in Investment 2001. Regulations on shareholding have been altered. For projects in agriculture, animal husbandry, fishery, mineral exploration and mining and service businesses under Schedule One of the Foreign Business Act B.E. 2542, Thai nationals must hold shares not less than 51 percent of the registered capital. Manufacturing projects in all zones may have majority or complete foreign ownership. The Board of Investment has discretion to fix shareholding at whatever level it deems appropriate.

**Table 8.2** Structure of investment in selected agri-food sectors, 1990

Item	Number of companies	Total investment	Investment in 100 percent Thai companies		Investment in joint ventures		Investment in wholly owner subsidiaries		Thai capital in total investment	
		(mill. Bt)	(mill. Bt)	%	(mill. Bt)	%	(mill. Bt)	%	(mill. Bt)	%
Milk and dairy products	12	631	173	27	358	57	100	16	305	48
Animal feed	84	5 159	1 420	28	369	71	60	1	2548	77
Livestock raising or meat processing										
Aquaculture	84	4 490	1 621	36	2 869	64	na	na	3535	79
Other	11	905	na	na	na	na	na	na	na	na
Slaughtering and processing of chickens for export	14	2 055	1 152	56	903	44	na	na	1721	84

*Source:* Burch (1996), p.328-9

## 9. Other issues

The agricultural industries are naturally going to be affected by policies relating to inputs, and a key one of these is finance. Development of new agricultural industries has been slowed by the reluctance of financial institutions to lend to farmers without land collateral. According to the Sectoral Economics Program (1995), in 1994 less than 37 percent of non-forest land had land titles that are able to be collateralised. Despite this, the authors of the Sectoral Economics Program point out that farmers have not had problems in obtaining short-term working capital from financial institutions. Whether this situation persists in the medium to longer term in light of the difficulties that the Thai financial sector now faces is unclear.

In discussing the livestock production systems in Thailand, Noppakun (1998) explains that livestock raising is intensive in the commercial farms in the dairy, beef fattening, pig, broiler and layer industries. The commercial farms are large and have sufficient financial and managerial resources to exist independently of government support. The extensive farms on the other hand make little use of marketable inputs and produce a combination of food crops, livestock and poultry. On these farms, livestock production and poultry production are of secondary importance compared to the other farm activities. This aspect of the livestock sector means that it is difficult to gather detailed information on technical parameters of the industries. Commercial farms are reluctant to divulge this type of information for commercial reasons and the operators of the extensive farms usually do not have the information. Vertical integration is a feature of the Thai agricultural sector. Major firms include Saha Farms Co., Ltd and Charoen Pokphand.

- Saha Farms began operations in 1969 with a weekly production of 500 chickens. By 1974, it had begun exporting frozen poultry to Japan. Continued growth has seen it transformed into a fully integrated chicken meat production business with three feedmills capable of producing 350 000 to 500 000 t. of chicken feed per year and a grandparent and parent stock operation producing between 73 million and 109 million day old chicks. Saha Farms has between 3000 and 5000 contract growers producing broilers that are processed in Saha Farms' two processing plants. There are approximately 10 000 employees on the firm's payroll.
- Charoen Pokphand (CP) began as a small seed shop in Bangkok's Chinatown in 1940 operated by two brothers who had migrated with their father to Thailand in the 1920s. In the 1940s, the firm began to import animal feed and fertilizer. By 1954, Charoen Pokphand had launched its own feedmill business. By the 1970s, the company had a "virtual monopoly on the supply of  
Phongpaichit and Baker 1996, p11). Over the next 20 years, CP's expansion continued and it became active in poultry, pig raising, feed mills, aquaculture, telecommunications, petroleum, retailing and a number of other industries. It has branches throughout Asia (including China), the Middle East, Europe, North and South America and South Africa.

## 10. Concluding Comment

The material in this paper provides information on a broad range of issues related to the livestock sector of Thailand. Such information is useful in designing policies for the livestock sector overall and for individual livestock industries. The design of appropriate policies will assume increased importance since the livestock industries are expected to grow with economic growth in Thailand. However, information on the livestock industries is limited and this makes the job of the policy adviser difficult since there will be a great deal of uncertainty as to the specific effects of particular policy initiatives or developments.

**Table A1** Characteristics of beef industry of Thailand

Year	Inventory	Supply of cattle	Demand	Imports	Farmgate price of live cattle	Wholesale price of live cattle	Retail price	Retail price of pork	Price of imported beef	Per person income	Population
	(000 head)	(head)	(head)	(head)	(Bt/kg)	(Bt/kg)	(Bt/kg)	(Bt/kg)	(Bt/kg)	(Bt)	(000)
1978	4436	1197800	854336	57402	10.12	13.24	29.54	34.65	86.15	18312	44455
1979	4277	1154900	867939	84643	10.65	15.57	33.18	37.64	94.82	18762	45460
1980	3938	1063400	936627	58374	14.69	17.86	48.81	45.66	146.09	19146	46718
1981	4469	1206700	940603	73941	17.77	26.92	55.67	48.76	146.67	19711	47718
1982	4578	1236820	982461	76860	17.76	27.5	56.72	47.77	158.59	20389	48709
1983	4833	1305000	978519	98264	18.29	27.35	56.44	52.18	169.51	21136	49680
1984	4789	1293100	964257	137180	18.25	27.29	56.7	51.42	177.98	21946	50637
1985	4829	1303900	972867	171232	20.41	27.68	56.7	42.53	157.77	22549	51580
1986	4878	1317200	956769	153719	21.19	28.1	56.3	43.94	156.54	23438	52511
1987	4970	1342000	971915	188744	20.93	28.12	53.21	48.99	165.53	25292	53427
1988	5072	1369000	974130	162340	24.23	32.24	57.47	53.39	205.73	28246	54326
1989	5286	1427400	980254	265797	23.51	36.12	63.57	58.52	198.32	31260	55214
1990	5458	1473800	1027310	508017	25.07	34.74	66.15	59.12	145.4	34443	56082
1991	5631	1520500	1110008	797828	25.78	39.81	67.92	64.49	97.34	39795	56923
1992	5816	1570500	1140367	1198344	25.97	45.53	70.12	70.82	83.82	39128	57760
1993					24.19	45.53	70.86				

**Table A2** Numbers of beef and work cattle held on farms of different areas and with different size herds, 1993

<b>Size of holding</b>	<b>North east</b>	<b>Northern</b>	<b>Central</b>	<b>Southern</b>	<b>All Kingdom</b>
< 2 rai	113074	201687	199016	27231	541008
2 – 5	186402	349896	155592	120404	812294
6 – 9	236057	250881	104089	125590	716617
10 – 19	782728	460540	317346	271534	1832148
20 – 39	1076793	434479	431794	243575	2186641
40 – 59	466255	194126	213836	81391	955608
60 – 139	342638	186385	202823	55636	787482
140 and over	72401	78462	97858	15901	264622
<b>Size of herd</b>					
1 – 2	353799	128934	60700	161015	704448
3 – 4	609413	163804	144329	274790	1192336
5 – 9	977408	336386	314937	308690	1937421
10 – 19	671599	466359	376504	126215	1640677
20 – 49	475035	669483	499919	64617	1709054
50 – 99	139318	283036	290355	24685	737394
100 – 499	39876	100399	204739	16918	361932
500 and over	11900	8055	27008	6649	53612
<b>Total</b>	<b>3278348</b>	<b>2156456</b>	<b>1918491</b>	<b>983579</b>	<b>8336874</b>

*Source:* National Statistics Office (1966a, 1966b, 1966c, 1966d)

**Table A3** Numbers of beef cattle by region

<b>Year</b>	<b>Region</b>				<b>Total</b>
	Central	North east	Northern	Southern	
1986	1211084	1501736	979739	595297	4287856
1987	1193136	1490067	1051569	595751	4330523
1988	1237185	1553524	1120073	589958	4500740
1989	1363614	1762387	1239528	621412	4986941
1990	1479527	1959185	1417016	655265	5510993
1991	1704775	2286484	1731145	713373	6435777
1992	1846544	2418377	1866620	767439	6898980
1993	1711923	2713393	2047417	762651	7235384
1994	1659101	2874947	1986639	885045	7405732
1995	1627590	2811216	1955937	927078	7321821
1995/1986	1.34	1.87	2.00	1.56	1.71

*Source:* Department of Livestock Development (1996)

**Table A4** Numbers of buffalo in Thailand

Year	Region				Total
	Central	North east	North	Southern	
1984	412 849	3 699 938	844 844	161 282	5 118 913
1985	374 845	3 936 178	792 261	148 949	5 252 233
1986	334 798	3 764 385	742 750	138 861	4 980 794
1987	316 045	3 602 539	646 085	118 930	4 683 599
1988	300 364	3 564 860	650 696	103 906	4 619 826
1989	286 439	3 646 048	583 184	96 021	4 611 692
1990	303 329	3 735 930	564 669	90 362	4 694 290
1991	324 752	3 817 452	566 360	96 507	4 805 071
1992	310 090	3 792 678	532 975	92 528	4 728 271
1993	287 048	3 908 575	524 790	83 733	4 804 146
1994	255 971	3 460 440	431 025	77 355	4 224 791
1995	228 023	3 009 063	398 562	74 413	3 710 061
1995/1984	0.55	0.81	0.47	0.46	0.72

*Source:* Department of Livestock Development(1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

**Table A5** Dairy Cattle in Thailand

Year	Region				Total
	Central	North east	North	Southern	
1986	51 708	5 705	4 686	1 506	63 605
1987	55 598	4 163	5 829	2 086	67 676
1988	68 908	14 881	8 563	2 575	94 927
1989	103 041	16 463	10 346	2 926	132 776
1990	118 052	25 234	11 022	3 229	157 537
1991	151 067	25 539	10 618	3 970	191 194
1992	168 213	38 355	11 879	4 052	222 499
1993	166 688	46 121	19 609	4 771	237 189
1994	164 199	47 355	14 861	5 203	231 618
1995	185 370	79 678	16 706	5 493	287 247
1995/1986	3.58	13.97	3.57	3.65	4.52

*Source:* Department of Livestock Development(1995) for data from 1986 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

**Table A6** Numbers of dairy cattle held on farms of different sizes

<b>Farm area</b>	<b>North eastern</b>	<b>Northern</b>	<b>Southern</b>	<b>Central</b>	<b>All Kingdom</b>
< 2 rai	1 970	3 767	14 585	1 039	21 361
2 - 5	4 477	6 535	18 860	3 396	33 268
6 - 9	4 897	4 024	10 131	3 510	22 562
10 - 19	14 937	6 738	21 868	7 958	51 501
20 - 39	18 054	5 655	34 017	8 115	65 841
40 - 59	73 28	1 972	15 342	3 445	28 087
60 - 139	74 06	2 161	14 303	2 284	26 154
140 and over	144 89	1 473	11 152	816	27 930
<b>Size of cattle herd</b>					
1 - 2	4 954	1 574	883	570	7 981
3 - 4	8 485	3 143	2 839	1 300	15 767
5 - 9	15 291	6 260	17 420	2 535	41 506
10 - 19	14 052	7 326	48 750	1 951	72 079
20 - 49	11 923	7 014	48 434	1 391	68 762
50 - 99	3 739	3 301	10 933	784	18 757
100 - 499	3 814	3 702	75 92	1 923	17 031
500 and over	11 300	5	34 07	1 300	16 012
<b>Total</b>	<b>73 558</b>	<b>32 325</b>	<b>140 258</b>	<b>11 754</b>	<b>257 895</b>

*Source:* National Statistics Office (1966a, 1966b, 1966c, 1966d)

**Table A7** Chicken numbers by regions

<b>Year</b>	<b>Region</b>				<b>Total</b>
	Central	North east	North	South	
1984	28 281 345	19 310 228	11 901 403	4 877 919	64 370 895
1985	33 761 426	20 142 048	11 245 836	4 871 478	70 020 788
1986	50 004 594	21 505 492	10 901 423	4 912 911	87 324 420
1987	54 305 043	20 747 690	11 985 012	5 096 038	92 133 783
1988	52 469 885	20 356 965	11 832 510	5 152 847	89 812 207
1989	56 292 910	22 251 117	11 598 141	6 452 096	96 594 264
1990	62 732 477	24 549 720	13 128 237	7 148 889	107 559 323
1991	79 649 695	26 308 701	16 656 749	8 222 249	130 837 394
1992	82 342 344	26 335 705	15 279 767	11 217 760	135 175 576
1993	83 246 791	25 916 449	19 299 493	10 369 294	138 832 027
1994	72 163 615	24 348 503	21 603 271	11 881 709	129 997 098
1995	62 587 266	24 446 914	15 039 270	9 575 060	111 648 510
1995/1984	2.21	1.27	1.26	1.96	1.73

*Source:* Department of Livestock Development(1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.

**Table A8** Numbers of swine in Thailand

Year	Regions				Total
	Central	North east	North	South	
1984	2 387 485	1 229 449	1 272 945	453 157	5 343 036
1985	2 986 523	1 181 150	1 288 093	463 076	5 918 842
1986	3 189 965	1 153 302	1 141 806	387 447	5 872 520
1987	3 409 527	1 072 110	1 029 344	355 905	5 866 886
1988	3 033 011	1 221 207	1 130 287	355 894	5 740 399
1989	3 093 289	1 393 815	1 043 283	485 011	6 015 398
1990	4 059 541	1 448 421	1 284 897	556 851	7 349 710
1991	4 642 614	1 616 615	1 362 850	580 393	8 202 472
1992	4 466 067	1 594 233	1 515 526	756 842	8 332 668
1993	4 307 256	1 830 633	1 650 352	780 885	8 569 126
1994	4 636 895	1 523 744	1 545 303	773 458	8 479 400
1995	4 656 843	1 414 974	1 717 817	772 287	8 561 921
1996	5 332 550	1 360 637	1 194 921	819 779	8 707 887
1997	5 763 198	1 890 084	1 455 986	1 029 772	10 139 040
1998	4 846 228	1 688 647	1 257 636	979 764	8 772 275
1999	4 145 954	1 463 789	1 040 555	772 803	7 423 101

**Source:** Department of Livestock Development(1995) for data from 1984 to 1993 and Department of Livestock Development (1996) for 1994 and 1995 data.