

**Livestock Industries of Indonesia prior to
the Asian Financial Crisis**

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FOREWORD

Agriculture in developing countries such as Indonesia will play an important role in preventing food shortage and producing raw materials for industrial purposes. On the one hand, animal products are essential for the development of human resources, while on the other, increasing human population significantly increases the demand for meat, milk and eggs. The annual increase in national livestock production in Indonesia is projected to contribute significantly to the gross domestic product. This should be matched with a higher growth factor for meat, taking into consideration the inevitable price changes.

In the traditional farming systems, livestock production is an income generating activity, providing a type of insurance to landless farm labourers so they can cope with emergencies, large expenses and social commitments. In Indonesia, livestock production is a labour intensive enterprise. Smallholders raise almost 90% of the animals in the country. In order to achieve sustainable production systems it is essential to implement proper management practices including genetic improvement, feeding and nutrition, and disease control, to ensure the achievement of optimal production levels. In particular, under intensive production systems, the roles of genetics, nutrition and disease control are incomplete unless due consideration is given to economic benefits. The task ahead therefore, is to develop appropriate means for the implementation of technologies that are technically feasible, economically viable, socially acceptable and environmentally sound.

In years to come, Indonesia will face major challenges in coping with various pressures, including population explosion, global influences and transformation of economic structure. The World Trade Organization (WTO) is an example of the pressures of globalization that need careful attention. Changes in global information systems, communication and economic integration will make it essential to enforce regional co-operation. This will need fundamental changes in investment policies, production, consumption, commerce and transportation. Co-operative measures should be considered in order to reduce the heavy burden in meeting the demand for meat, milk and eggs in the future. Increased competitive ability in livestock production for local export markets would provide better opportunities for development.

In order to assist Indonesia in facing the challenges faced by the livestock sector, FAO commissioned a review to assess the potentials, constraints, capacities, policy issues, strategies and options affecting the industry in the country. The review also includes backward and forward linkages of livestock production, in particular, on feed and feeding technologies, livestock product processing, and trade matters. This publication reports on the findings of the above-mentioned review, focusing on the following key areas:

- demand and supply trends of livestock products and projected demand/supply gaps;
- comparative advantage of livestock production in Indonesia;
- analysis of factors affecting the industry, such as policy and institutional constraints both on-farm and off-farm (processing, marketing);

- integration of livestock into farming systems in Indonesia;
- identification of priority areas and institutional reforms for consideration by those involved in concepts for technical assistance projects and ideas for the livestock sub-sector.

The review is expected to stimulate the development of alternative strategies for development of the livestock industry. It is hoped that the review will bring about new perspectives regarding the livestock industry to policy and decision makers.

Your comments for improvement of this review are welcome.

Prem Nath
Assistant Director-General
and Regional Representative
for Asia and the Pacific

1. **KAMPUNG CHICKENS: A KEY PART OF INDONESIA'S LIVESTOCK SECTOR**

Kusuma Diwyanto

Central Research Institute for Animal Sciences, Jl. Raya Pajajaran, Bogor 16151, Indonesia

and

Sofyan Iskandar

Research Institute for Animal Production, P.O. Box 221, Bogor 16002, Indonesia

Kampung chickens are raised using traditional production techniques by almost every village household. They are a side-line activity and are not considered the main source of family earnings. The members of a family generally work in crop cultivation, as labourers, or as traders. Although some families keep more than 1 000 birds, they still work in other activities for their main livelihood. In some cases, farmers have integrated their native chicken operations with freshwater fish farming by constructing the cages above the fish-pond. This enables the fish to use chicken feed and manure for food. The manure is commonly used as organic fertilizer, but it is rarely collected on the smallholder farms. Significant amounts of manure are collected on the large farms, and this can become a source of revenue for the farmer.

Kampung chickens have been raised by most of the rural population of Indonesia and they represent an important source of meat and eggs. Although consumed by the family on most family occasions, *kampung* chickens are not able to provide consumption on a daily basis because of their low production. *Kampung* chickens play a very important role in the cash flow of rural people provided that they do not suffer from infectious diseases such as Newcastle disease (ND). *Kampung* chickens do not have specific characteristics, and vary in performance and plumage from bird to bird.

Apart from the *kampung* chicken, other breeds of native chicken have been commonly regarded as local to a specific area. Examples are the *Pelung* chicken, a large singing cockerel that originated in West Java, the *Kedu*, a high egg producer from Central Java, and the *Nunukan*, a breed claimed to have originated in Eastern Kalimantan. These chickens, however, exist only in small numbers and have been kept by only a small number of villagers

as exotic birds. Nonetheless, they are a livestock species that should be conserved. In fact the Government of Indonesia through the National Committee on Genetic Resources has considered including native chickens, including the *kampung* chicken, in its conservation programme.

STATISTICS OF *KAMPUNG* CHICKENS

According to the *Statistical Book on Livestock* released by the Directorate General of Livestock Services (1997), the total number of *kampung* chickens from the 27 provinces in Indonesia has been increasing (DGLS, 1997). In 1990, the total number of *kampung* chickens of all ages was 201 million birds; by 1996, their numbers had increased to almost 260 million birds, or by approximately 29 percent. *Kampung* chickens are concentrated in Java island where about 43 percent of the population is found. The numbers of *kampung* chickens seem to be positively correlated with human population. However, they are rarely found in the city areas because of space limitations.

Table 1.1. Numbers of *kampung* chickens in Indonesia

Region	Number of <i>kampung</i> chickens							Change per year
	1990	1991	1992	1993	1994	1995	1996	%
	(million)	(million)	(million)	(million)	(million)	(million)	(million)	
Sumatra	55.30	58.57	63.20	67.99	72.59	78.99	83.41	8.47
Java	92.77	93.89	98.59	103.57	100.74	107.87	110.78	3.23
Kalimantan	11.20	11.80	18.82	13.12	14.53	14.79	16.64	8.09
Sulawesi	25.57	26.61	29.47	17.23	19.53	25.68	25.33	-0.15
Bali & Nusa Tenggara	13.80	15.62	15.94	17.30	18.42	19.21	19.98	7.47
Maluku, Irian Jaya, East Timor	2.72	3.10	3.45	3.68	4.10	3.54	3.74	6.17
Indonesia	201.36	209.59	229.47	222.89	229.91	250.08	259.88	4.84

Source: DGLS (1997)

The cities are now becoming an important market for *kampung* chickens. A survey reported by Hermanto *et al.* (1995) has investigated consumption in villages and cities. The villages and cities were divided on the basis of income into low, medium and high income groups. It was found that more *kampung* chicken was consumed by the highest income group, reaching 2.36 kg per person per year, while about 1.54 and 0.84 kg meat per person per year was consumed by the medium and low income groups, respectively. Further, it was found that the

consumption of meat from improved chickens was 2.55 kg per person per year for the high-income group, compared to villagers who ate only 0.74 kg per person per year.

The development of *kampung* chicken as a livestock industry is influenced by the fact that the improved poultry industry requires commercial rations, consisting mostly of imported ingredients. Technology packages have been introduced by the government to increase the population of *kampung* chickens particularly in the villages that are in close proximity to the cities. This is being done because the cities are seen as a market for *kampung* chickens.

Most *kampung* chickens have a long marketing chain. Some village collectors carry bamboo cages holding about 20 to 30 mature *kampung* chickens. The collectors travel around the village, paying in cash for one or more live chickens from the village households. The village collectors usually collect in the afternoon and sell early in the morning of the next day to larger collectors who arrive from the cities. The transaction is in cash, for between 500 and 1000 birds each time. There are usually two or more big collectors in each collecting area and they are provided with birds by ten or more local collectors. Although transactions can take place every day, twice a week is perhaps more usual. Information about this trading system is limited. It might not be found in every village in Java because its success depends on the concentration of *kampung* chickens. The system is mostly found on the north coast of West and Central Java while farmers in other areas sell their chickens in a local public market or livestock market.

To support the development of the *kampung* chicken industry, the local government has introduced an intensive farming system programme for *kampung* chickens. Since the 1980s, some 3000 to 6000 *kampung* chickens have been given to 20 to 50 households, in a number of projects. The size of the flock on each farm increased from seven birds in 1990 to nine birds per household in 1996. The distribution of chickens depends on the local government's plan in setting up the programme each year. For example, the local government of West Java introduced two projects in 1995 involving 7 000 mature *kampung* chickens for an intensive farming system programme involving two groups of farmers in two districts. During the same year, in South Sulawesi, 6 000 mature chickens were distributed to 60 households. If this programme were to run in all 27 provinces, then after a decade about 270 groups of 20 to 50 farmers could be expected to have participated in the programme with 1.62 million birds being allocated to these farmers. In such a case, only 0.6 percent of the total population of birds would be kept by small number of farmers, while the greatest number of marketed chickens would come from the traditional smallholders with less than 10 birds per household.

The contribution of *kampung* chickens to national egg production was 96 560 t in 1994 or about 17 percent of total egg production. Although there are no consistent data on the consumption of *kampung* chicken eggs, consumption appeared to be higher in the cities (3.90 kg per person per year) than in the villages (2.93 kg per person per year). Any increase in the intensive farming of *kampung* chicken is likely to increase its contribution to the development of a national poultry industry.

GOVERNMENT POLICIES

The government introduced a programme called INTAB (intensification of *kampung* chicken) in the 1980s, targeting groups of farmers who co-operatively participated in the provincial projects. As mentioned earlier, each project consisted of a group of 20 to 50 farmers receiving a package of technology for *kampung* chicken farming. The package provided 100 mature female birds, medicines, cages and temporary feed consisting of commercial feed and local ingredients (mostly rice bran). Training of the farmers was one part of the project and it was usually undertaken before the farm was set up. The government offered technology to each farmer. The local government also provided technical supervision during the term of the project, which in most cases was one year. The project's progress was also monitored. Project supervisors assisted in the establishment of a farming system and in its business management, including the securing of loans, banking and marketing activities.

Following the fast development of the improved poultry industry, the intensification of *kampung* chicken should be encouraged. The availability of feed ingredients, medicines and commercial rations for the improved poultry industry has led to intensification in *kampung* chicken rearing and this should assist the industry to continue to exist and to expand.

Following the INTAB programme, another programme called INVAK was introduced to vaccinate *kampung* chickens against ND. This programme has led the farmers to understand that ND can be prevented by using an injection or an eye- or nose-drop vaccine. However, the programme is not able to cover all *kampung* chickens reared under the traditional system, even though the vaccine has been widely available throughout Indonesia from poultry shops. (The number of poultry shops has been increasing.) In practice, it is difficult to vaccinate scavenging chickens against ND. Scientists at the Research Institute for Veterinary Science (RIVS) of the Agency for Agricultural Research and Development (AARD) have been developing a new ND vaccine for *kampung* chickens. The vaccine was developed from a local isolate and is given orally through chicken feed and/or laterally as a contact transmission (Darminto, 1997). The results so far have indicated that vaccination in the scavenging *kampung* chickens does not give sufficient protection against ND, as compared to confined flocks of birds.

The attempt to increase the production of *kampung* chicken has to some extent been successful, particularly in areas where feed, medicines and other facilities are easily obtained. In remote areas with insufficient facilities, the programme has been less successful. Keeping the chickens in cages provided with feed, water and medicine reportedly decreases mortality and increases productivity. Furthermore, the government has recently launched a programme called "Pengembangan Peternakan Rakyat Terpadu Berorientasi Agribisnis" or Integrated *Kampung* Chicken Industry (Diwyanto *et al.*, 1996). The programme has an agribusiness orientation and is a continuation of the INTAB programme. Co-operators in this programme include those who are experienced with *kampung* chicken farming. Each region is selected according to the availability of support facilities, including physical facilities and infrastructure. The number of chickens raised by each farmer depends on whether production is for meat or eggs and whether a semi-intensive or fully intensive farming system is being used. This programme is expected to increase the population of *kampung* chickens and eventually to increase farmers' incomes.

RECENT AND PREDICTED CHANGES OF MARKET/INDUSTRY SIZE

As mentioned above, the *kampung* chicken industry has been limited to smallholders and traditional farms. Production of meat and eggs from *kampung* chicken has been increasing from year to year, although it is still lower than that of improved chicken. In 1996 the population of the *kampung* chicken was almost one third of the improved chicken population. It is generally accepted that *kampung* chicken has lower productivity and a longer production cycle than improved chicken. However, the development of livestock industries, including *kampung* chicken, will be determined by income growth. The population of *kampung* chickens can be projected using estimates of the income elasticity demand for *kampung* chicken products. Soedjana (1996) has projected changes in demand for the meat and eggs of *kampung* chickens until the end of the Sixth Five Year Development Plan, PELITA VI (Table 1.2).

Table 1.2. Projected demand for meat of *kampung* chicken in Indonesia by the end of the Sixth Five Year Development Plan

Region & income groups	Income elasticity	Low projected growth	High projected growth
		(% per year)	(% per year)
Village			
• Low income	3.39	10.17	16.95
• Medium income	1.29	3.87	6.45
• High income	0.57	1.71	2.85
City			
• Low income	3.04	15.20	21.28
• Medium income	2.51	12.55	17.57
• High income	0.73	3.65	5.11

Source: Soedjana (1996)

METHODS OF HUSBANDRY AND INTEGRATION INTO FARMING SYSTEM

Three *kampung* chicken farming systems are currently practised. A traditional farming system with a small number of chickens is common for most village families. The birds are left to scavenge in the backyard or in the garden, and are provided with limited facilities such as a simple cage and a small amount of food scraps or sometimes rice bran. Five to 12 eggs are brooded by hens in each clutch and the chicks are raised for three months. Losses of young chickens can be high, sometimes reaching 100 percent. Nonetheless, under this production system, farmers still get some benefit from selling or consuming the chicken. However, the additional revenue from *kampung* chickens is unpredictable, and the chicken activity is considered to be a part of family savings.

The second farming system is semi-intensive. Considerable care is given to the chickens, including vaccination. As well, young chicks are given two weeks of full feeding after

separation from the hen. The number of birds kept can be as high as 50. The chickens are usually allowed to scavenge in the backyard or in the garden after morning feeding and are then brought back to their cages in the afternoon. Eggs and meat from young and culled chickens are produced in this system. If meat is the main product, additional income of from Rp. 10 000 to Rp. 150 000 per month could be generated if the system is well maintained. If eggs are the main product, additional income may increase to Rp. 100 000 per month. However, the number of farmers using this system is very small compared to the traditional system.

The third system is an intensive farming system, in which *kampung* chickens are kept in cages with a full feeding programme throughout the production period. This system is the outcome of the government programme concerned with the intensification of *kampung* chicken and the development of an improved poultry industry. The number of chickens kept under this system needs to be at least 100 mature hens and they are usually in individual cages for egg production. A farmer will normally look for pullets at the beginning of the production period and at the replacement period for older hens. The cost of this system is high because of the capital investment for cages, the cost of young pullets and commercial feed, and the amount of labour required. With family management of 200 hens, the system will yield as much as Rp. 180 000 per month (Diwyanto *et al.*, 1996). Meat can also be produced from culled hens, leading to the conclusion that the system is a suitable family operation.

The intensive system for meat production has not become popular yet, because it requires skill and more investment for breeding, hatching and keeping young chickens to market weight. A government programme called Village Breeding Centre (VBC), introduced in the late 1980s or early 1990s, seemed to have been unsuccessful. A ranch system was introduced in the VBC on 6 m² of land with 10 mature hens and 2 mature cockerels being mated. Eggs were collected and incubated. This ranch system was found to be not efficient, so the Research Institute for Animal Production (RIAP) attempted to introduce an Artificial Insemination (AI) technique for intensive egg production as an alternative to the ranch system. The programme seemed to work and was explained to the extension officers of the Livestock District Office. However, the success of the AI programme has not been evaluated yet.

Little labour is required for the traditional system, because the farmers are not using *kampung* chickens as the main income source. Control of ND with the assistance of the government could improve the traditional smallholder system. The semi-intensive system might also be improved by increasing the skills of farmers, and through the provision of credit and the creation of a reliable market. The intensive system could be developed by increasing the numbers of birds kept and by providing input and output facilities close to the area where development of the industry is planned. However, the industry has not produced enough young chicks and this is a major constraint facing the *kampung* chicken farming system.

On the other hand, feed costs have increased, and this is regarded as a constraint for the poultry industry. This situation could be worsened by the difficulties facing the economy through increased prices of imported soybean meal, fishmeal and corn grain. Furthermore, the national production of soybean and fishmeal is currently very poor.

The low productivity of the *kampung* chicken in meat and eggs is obvious compared to improved chickens. The *kampung* chicken is a domesticated native bird that has not been

improved genetically through a major selection or cross-breeding programme. Table 1.3 shows the performance of the *kampung* chicken.

Table 1.3. The biological performance of *kampung* chicken under intensive management

Production stages	Body weight	Feed consumption	Other
Egg weight:			41 g/egg
Day old chick	30 g/bird		
4 weeks old	145 g/bird	350 g/bird	
12 weeks old	798 g/bird	3 500 g/bird	
16 weeks old	1 261 g/bird	5 317 g/bird	
Age of first egg			21.6 weeks
Age at 40% egg			26.3 weeks
Peak production			55% hen day
52 weeks egg prod			131 eggs
Feed conversion			4.9 kg feed/kg egg

Source: Iskandar (1994)

In comparison to the biological performance of improved chickens, *kampung* chickens are genetically capable of producing about half as many eggs and even less meat. Mortality rates depend entirely on the management system being applied; the more hygienic the management, the lower the mortality. Under an intensive management system, mortality rates to 20 weeks of age are no higher than 9 percent.

Dressing percentages at 12 weeks of age are about 63 percent of live weight, with a very low abdominal fat pad (0.82 percent of live weight). Culling age depends on market demand with 750-1000 g liveweight usually preferred. Culled or spent hens are worth as much as a pullet.

The mean biological performance of birds under the traditional system appears to be below the performance of birds under intensive management. Mortality could be up to 100 percent, with poor growth rate. Age at first lay might be six to seven months with production of about 40 eggs per year. The hens are usually culled after two or three years. It is generally thought the traditional industry would not be completely destroyed by a severe ND outbreak.

An increasing focus on healthy food, low cholesterol and low fat meat and egg products might increase the demand for meat and eggs of *kampung* chickens, particularly by consumers who live in cities. Indications are that improved chickens selected for high growth rates could produce more meat with a considerable amount of body fat (about 3 or 4 percent abdominal fat, 1.3 percent breast fat, 6.8 percent thigh fat and 34.2 percent skin fat) compared to *kampung* chicken (about 0.82 percent abdominal fat, 0.8 percent breast fat, 4.4 percent thigh fat and 21.6 percent skin fat) (Triyantini *et al.*, 1997). *Kampung* chickens have provided the meat ingredients for certain famous delicatessens such as “Mrs Suharti Fried Chicken”, and many “Padang-Restaurants” fried and casserole chickens. In meat preference tests, based on the Department of Trade’s standard of table meat quality, *kampung* chicken reached a

value of 80 percent compared to improved chicken which had a value of 53.3 percent. The texture and thickness of the meat of *kampung* chicken were much better than for improved chickens. This might have been a consequence of their being marketed at a younger age.

It is interesting to note that the prices of meat and eggs from *kampung* chickens are much higher than the prices of eggs and meat from improved chickens. The price of improved broiler chickens varies from one province to another. In 1995, the liveweight price of improved broiler chickens was as high as Rp. 5 500 per kg in North Sulawesi while the lowest price was Rp. 2 000 in West Kalimantan. In Jakarta, the price was about Rp. 2 576. At the same time, *kampung* chicken reached a high price of about Rp. 9 000 per kg liveweight in Maluku. The lowest price, about Rp. 4 600, was recorded in West Nusa Tenggara, while in Jakarta it was Rp. 8 000 per kg live weight. Such price differences will certainly encourage the national *kampung* chicken industry to develop, but it will not be able to develop at the same pace as the improved chicken industry.

Eggs of *kampung* chicken are sold by number, and improved chicken eggs are sold by weight. One kilogram of *kampung* eggs will have 24 to 25 eggs and will sell for Rp. 10 000. Eggs from improved layers sell for about Rp. 5 500 per kg.

Action should be taken to stimulate the future development of the *kampung* chicken industry. It can make a great contribution by supplying meat and eggs, together with other kinds of poultry such as local ducks, quails, and improved chickens. In terms of income distribution, *kampung* chickens can affect large numbers of small farmers. As well, they help to make animal protein become available to almost all, including the low income groups in society. Small subsidies on ND vaccination from the government for the traditional industry might sustain the existing population and even increase it. For the semi-intensive system and the fully intensive system, breeding to produce more day-old chicks that are genetically improved but unchanged in flavour, and the establishment of business institutions through village co-operative units, would contribute significantly to the industry.

As well, research on native poultry should be intensified in order to reduce import requirements. Indonesia has put a lot of effort into research on improved chickens in the last two decades. Native chickens, which are also considered to have genetic potential worth conserving, are becoming a priority in national poultry research. As a short cut, to meet an immediate need for high production, the RIAP has set up research on cross-breeding *kampung* chicken with *Pelung* chicken for meat production without ruining the genuine meat quality. In another experiment, the native sires have been crossed to improved layers in order to speed up F1 multiplication and growth rate. However, the end result has been a bird with low consumer acceptability. Despite this setback, similar research activities are expected to become a priority, especially to overcome any import-related crisis, which might put a lot of pressure on the industry.

It is reasonable also to put effort into increasing the production of corn, soybean and other grains, and into finding some cheap unconventional feeds. The possible use and improvement of agricultural waste products such as coconut meal, cassava, the sludge of oil palm, palm kernel meal, and cocoa waste needs to be further investigated as a possible input into the chicken feed industry. The RIAP has also recommended some increase in the use of protein enrichment technologies involving microbes.

CONCLUDING COMMENTS

Kampung chickens that are mostly raised by every village household have the potential to increase income and generate employment, as well as contributing to the national supply of meat and eggs. The constraint is that their low productivity needs to be improved through the implementation of appropriate technology and development programmes that are economically profitable, socially acceptable and environmentally sound. The prices of meat and eggs of *kampung* chickens in the market are much higher than those of improved chickens. This provides the industry with an important advantage and gives the industry its promise.

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2. NUCLEUS SCHEME FOR SMALLHOLDERS (PIR) IN THE BEEF CATTLE INDUSTRY OF INDONESIA

Subandriyo, I.G. Putu, Agus Suparyanto and Ismeth Inounu

Research Institute for Animal Production, P.O. Box 221, Bogor 16002, Indonesia

The concept of the partnership model under a Nucleus Smallholder Scheme (Pola Intirakyat, or PIR) in the beef cattle industry was inspired by a successful similar programme in the estate crop sub-sector. The main objective of the programme is to minimize the burden of farmers as partners, with the assurance of the nucleus to supply raw materials and market the final products. A partnership, as the basic programme to develop agribusiness in villages, is considered very promising to farmers in many aspects of life.

The concept of PIR has attracted government attention because of competition between the subsistence farmers and large-scale enterprises in the production and marketing of final products. The bargaining position of subsistence farmers is very weak because they cannot guarantee product supply. This weakness could be reduced if subsistence farmers could organize themselves under a co-operative scheme and could find a business partner who shared their objectives. On the basis of such an agribusiness-oriented approach, it is expected that the performance of the farmer could be improved and this would create more employment opportunities in the villages. As a result, it is also expected that the farmers, through development under the programme, could become the backbone of the industry in meeting the demand for meat.

Most cattle farmers are subsistence farmers as judged by the ownership status of cattle. They only raise cattle to obtain the benefit of having offspring and the increase in body weight when the animal is fattened. Theoretically, the number of feeder cattle produced from the offspring has the potential to support a long term fattening programme in Indonesia. Therefore, it is expected that, given the opportunity, the economic development of villages could improve, because the type and characteristics of this business are closely linked to farmers' daily life.

Soekartawi (1994) shows that there has been excellent growth, by up to 5-6 percent per year, in the estate crop, livestock and fisheries sub-sectors. This development has given the government an incentive to develop these sub-sectors further. However, there are also negative issues that can hamper the approach. According to Simatupang *et al.* (1995), any report that focuses on the

development of livestock PIR generally arouses heated discussion on the relationship between the nucleus and partners, mainly in terms of investment and profit sharing. Some policies that were designed to help the farmer in financial and managerial matters in many cases have turned out to corner the farmer.

The village co-operative unit (Koperasi Unit Desa, KUD), as a motivator and agent for farmers, should take a more proactive role in planning and implementing the programme. A harmonious partnership can be achieved if both parties are responsible and functioning well, with the involved government official providing sufficient supervision of the business pattern, so that complaints from both parties are prevented.

DEVELOPMENT OF THE CATTLE FEEDLOT INDUSTRY AND PRODUCTION CAPACITY

In Indonesia, the fourth most populous country in the world after China, India and the USA, the beef market provides an excellent opportunity for marketing agricultural products. Over the five years beginning in 1992, the demand for beef products grew significantly, reflecting the increasing income per person and strong urbanization. Because of these factors, consumption of red meat increased between 1995 and 1997 (Table 2.1).

Table 2.1. Demand for and supply of beef products, 1995-1997

Description	Year		
	1995	1996	1997
Beef demand (t)	381 000	450 702	498 000
Supply of beef (t)	359 000	437 181	468 000
Imported beef (t)	22 000	13 521	30 000

Source: APFINDO (1997)

In 1997, 358 000 t of the 468 000 t of beef were produced by traditional farming systems with indigenous breeds such as Bali, Ongole (Peranakan Ongole, PO) and Madura cattle. The feedlot industry contributed 80 000 t and another 30 000 t was supplied by imported beef. The demand for meat over the next five years will increase. However, a constraint is that the population of cattle in Indonesia has been increasing only 2 to 3 percent annually, while the demand for beef is likely to increase by up to 8 percent per year.

The increase in beef demand in the last few years has been anticipated, as shown by the number of cattle feedlots. In 1992, there were only five cattle feedlot companies located in Lampung, West Java and Central Java. By 1996, Sitepu *et al.* (1996) reported that the number of cattle feedlot companies had increased to 32, spread over 12 provinces. Most of them are located in the western part of Indonesia, such as West Java (8), Central Java (6), Lampung (6) and East Java (4). Yogyakarta, East Kalimantan, South Kalimantan, NTB, Riau, South Sulawesi, North Sulawesi and Irian Jaya each have one feedlot. In 1997, the number of cattle feedlots increased to 41 companies distributed through 13 provinces. All cattle feedlot companies in Indonesia are

under the Indonesia Beef Producer and Feedlot Association (APFINDO), an organization that was established in 1992.

Based on a survey of 14 cattle feedlots, Sitepu *et al.* (1996) also reported that production capacity of these feedlots varied between 1 000 and 60 000 head per year. Most of the cattle feedlot operations use imported breeds with a high preference for Brahman Cross (BX), Australian Commercial Cross (ACC) and Shorthorn Cross (SHX). The age of the imported cattle is around 1.6 to 2.5 years with an average body weight of 350 kg. The fattening period depends on the initial body weight and it varies between 60 and 90 days. The total number of feeder cattle imported by feedlot companies increased very sharply from 12 591 head in 1991 to 367 000 in 1996. Between January and July 1997, 235 658 head were imported (Table 2.2).

Table 2.2. Number of feeder steers imported by APFINDO members

	Year							Total
	1991	1992	1993	1994	1995	1996	July '97	
Feeder cattle	12 591	24 867	58 200	118 200	246 890	367 000	235 658	1 063 406

Source: APFINDO (1997)

The distribution of feeder stock is as follows: West Java 34 percent, Lampung 24 percent, Central Java 12 percent, East Java 6 percent and the remaining 24 percent in other provinces. Thus, 76 percent of feeder stock are fattened by feedlots in the western part of Indonesia.

DEVELOPMENT OF CATTLE FEEDLOTS UNDER THE NUCLEUS SCHEME

The operation of the PIR (nucleus scheme) with feedlot cattle in villages has been implemented in varied forms, using the experience of Lampung as a guide. The significant increase in the role of the nucleus scheme in assisting farmers is indicated by the willingness of farmers to join the scheme. The farmers have built cattle pens at their own expense. The total pen capacity built by the farmers in 1997 was 38 017 head, while the pen capacity of cattle feedlot companies was 197 339 head. Allowing for a 14 day quarantine period and a 60 day fattening period, the number of cattle able to be fattened by the farmers reached 171 076 head per year, and 888 025 head per year by the cattle feedlot companies.

The Great Giant Livestock Company (PT GGLC) carries out the nucleus scheme with available pineapple waste, sufficient to feed 7000 head of cattle throughout the year. This means that 21 000 head of cattle could be fattened each year, in three periods of four months. Apparently, the company only raises 2400 head of cattle. Hence, 18 600 head could in theory be raised by farmers. The GGLC has established two kinds of nucleus scheme, namely a “credit PIR” and a “self-supporting PIR” (SS-PIR).

The credit PIR scheme began in 1989 with an initial 20 head of cattle distributed to 20 farmers. Thus, each farmer received one animal. An economic farm size demands a certain number of cattle be raised by each farmer. In 1991, PT GGLC developed a co-operative arrangement with the KUD as the organizer of farmer activity.

The production target was 12 000 head of feeder cattle which were either imported or Ongole Grade (Peranakan Ongole, PO) feeder stock. The cattle were fed on pineapple waste to reduce feed cost. However, the operation only reached 2320 head of cattle, which was far below the target. In the five years 1991-1995, the number of animals in each farmer's package was increased to three, over the four months fattening period. The Brahman Cross cattle, chosen by the company, and all feed, production inputs and capital were provided by the company – the nucleus. The credit provided by the company is repaid at the end of the fattening period through the farmer selling the fattened cattle to the company.

The SS-PIR nucleus scheme developed by PT GGLC initially included only 20 farmers. The difference between the two kinds of PIR lies in the provision of capital: in the SS-PIR the capital was provided by the farmers themselves, while the raw materials were supplied by the company. The average farm size was 7 head of cattle per farmer, for a six month fattening period.

The feed, in the form of pineapple waste, is provided by PT GGLC on the agreement that at the end of the fattening period the farmer will sell the cattle to the company with the selling price being settled in advance. There is no interest applied to the value of the feed. Therefore farmers can get higher profits.

Another nucleus scheme for feedlot cattle was established by PT TIPPINDO (located in Central Lampung). This involved more than 35 farmer groups with 11 500 head of feeder cattle. In implementing the nucleus scheme, PT TIPPINDO selected as participants farmers who satisfied certain criteria. This was done in order to get better results. Before the start of the programme both parties would sign a contract or memorandum of understanding which specified that the farmer, as a member of the KUD, would provide corn forage (72-day corn plants), animal pens and labour. The memorandum of understanding required that the company would provide the feeder cattle and feed supplements such as concentrate, molasses and medicine, as well as technical supervision during the fattening period. Another nucleus scheme carried out by TIPPINDO is a corn planting programme to make corn silage. The company provides inputs such as corn seed, fertilizer and technical supervision, while the farmers provide land and labour. At the end of a 72-75 day period, the farmers sell the corn plants to the company at an agreed price.

PT Hayuni Mas Lestari (HML), which was established in 1989 and which is located in North Lampung, has been specializing in fattening Bali cattle with an initial body weight of less than 200 kg. Production capacity of 2400 head per year was not achieved. This company acts as a nucleus in the area and works together with farmers to do the fattening. In the province of Bali, a nucleus scheme was initiated in 1984. At the beginning, the programme showed good productive performance as indicated by an increase in the cattle population of around 38 percent per year. Also, the number of farmers involved in this programme increased by about 31 percent per year. However, in 1988 the productive performance declined because of a change in policy applied by the local government. This change shifted the performance of the nucleus scheme, so that the population of cattle raised by farmers dropped by 69 percent per year and the number of farmers involved also declined by 66 percent per year. According to Simatupang *et al.* (1995), this drastic reduction caused a change in local incomes and the policy resulted in an uncertain supply of feeder cattle from the nucleus company to the farmers. At the beginning of the scheme, feeder cattle were transported by the company. However, after a change in management policy, the feeder steers were transported by the Indonesian Animal and Product Trade Association (INDAPTA) which charged a fee.

A nucleus scheme in Lombok (West Nusa Tenggara) has been set up to enhance the supply of slaughter cattle for inter-island trade. In this particular scheme, it is the trader who is the nucleus, and the trader works hand-in-hand with local farmers. The nucleus provides feeder stock, and the farmers provide feed and raise the cattle to a certain body weight (300 kg). To achieve the desired body weight target, farmers raise the cattle for about 4-8 months, depending on the condition of the animals when they arrive at the farms (Sarwono, 1995).

THE ROLE OF GOVERNMENT POLICY IN THE NUCLEUS SCHEME

In 1992, when the nucleus smallholder scheme was approved by the President of the Republic of Indonesia in Lampung, the scheme became a government policy that had to be implemented by any cattle feedlot operator who used imported feeder cattle. Government officers, through the Directorate General for Livestock Services (DGLS), issued a regulation that at least 10 percent of imported cattle had to be distributed to local farmers under the PIR. The objectives of this programme were:

- to give local farmers a chance to increase their income;
- to improve the capability and skill of the farmers in managing small-scale cattle feedlots;
- to stimulate villages to take up activities that promote economic growth; and
- to improve sales of agricultural product(s) and by-products used by the feedlot companies.

Since 1997, the government, through the Directorate General for Livestock Services, has instructed all cattle feedlot companies in Indonesia using imported feeder cattle to increase the proportion of their PIR schemes with local farmers from 10 percent to 20 percent of the total imported feeder steers. This must be done by all cattle feedlots, whether run by foreign investment (PMA) or domestic investment (PMDN). In addition, the government has introduced a PIR for cattle breeding, to produce calves or feeder cattle and to substitute these for imported feeder cattle.

The nucleus scheme, a business based in the agricultural sector, should be considered as a system where all parties have mutual interest in all aspects of production, including management, marketing, and post-harvest processing. These linkages can be differentiated as forward linkages and backward linkages.

A linkage analysis has been done, separating the inputs and the outputs. The coefficient of forward linkage for the livestock sub-sector, especially ruminants, is more than one (1.108), while the coefficient of backward linkage is 0.776. This indicates that the cattle business puts emphasis on the consumer, in those cases when the product goes directly to the consumer without any post-harvest processing. This is different from the feed industries because the coefficient of forward linkage is smaller than the coefficient of backward linkage (0.766 versus 1.158). The implication is that the product is not delivered directly to the consumer but to other downstream industries (Soekartawi, 1994).

These results indicate that while upstream relations were maintained, the same could not be said of downstream relations. For example, it could happen that during some fattening periods the farmers did not make any profit because they did not receive the feed they needed because the feed was used by the nucleus for its own cattle. This did not happen in the poultry business, since there was not so much difference between the coefficients of forward linkage and

backward linkage (0.748 versus 0.768). The arrangement was therefore apparently beneficial for both upstream and downstream industries (Soekartawi, 1994).

Rahman and Erwidodo (1995) stated that a policy based on the use of tariffs and non-tariff barriers in milk production affected the allocation of production factors and benefits. Further, the level of nominal protection for milk – the difference between the price of the output in the country and the import price of the same commodity – was 32 percent at the consumer level at the time of their study. This shows that domestic consumers paid more than they would have paid without protection at the farmer level. At the industry level, the nominal protection was 38 percent. In the credit PIR, farmers with less than 4 head received the smallest nominal protection (only 24 percent) while farmers with 7 to 10 head received 34 percent. Those farmers with at least 13 lactating cows received 38 percent.

The level of effective protection (tingkat proteksi efektif, TPE) at the farmer level was 8.3 percent. This means that the producers of fresh milk got protection from the government in the form of higher output prices. At the level of the milk processing industry, Rahman and Erwidodo (1995) found there was a TPE of 20 percent.

The absence of a tariff on imported feeder cattle from Australia led to some operators reducing the scale of their fattening business, both at the nucleus and at the farmer level. This was based on the calculation that without fattening for three months, feeder cattle imported from Australia could be sold directly at a competitive price in the local market, and still provide a profit.

It is clear that farmers who raise local cattle, and also the consumers of meat produced from local cattle, do not get any benefit from the government policy of no tariffs for imported cattle. The impact of this policy on the fattening process in the PIR programme has not been evaluated yet. With the coming era of free markets and globalization, it is hoped that all policies can be re-evaluated.

In the last few years of implementation of the PIR in the cattle feedlot industry, a number of constraints have appeared at both the company and the farmer level. These include:

- the provision of finance at a low interest rate for the development of cattle feedlots under the PIR;
- the inability of farmers to receive feedlot management technologies from the feedlot companies;
- the restricted area of land for growing roughage for fattening purposes;
- the long dry season which is a major restriction to the supply of roughage for cattle feed; and
- the distance separating the cattle feedlot companies and the animal pens set up by farmers, which increases operating costs during the fattening period.

Additionally, the operators' limited education and capability in all parts of the nucleus scheme in the beef cattle industry hamper their adoption of new technology and management and limit their ability to make use of information. These factors, in turn, limit the ability of scheme participants to do business. Therefore, the smallholder farmers require guidance for success in the nucleus scheme. The concept of guidance has to be able to accommodate all levels of the nucleus scheme. At the farmer level, guidance should demonstrate how to increase the scale of operation. For problems related to husbandry, the guidance should focus on product quality, marketing, investment and management, so that farmers become aware of the economic aspects of the business.

FINANCIAL PERFORMANCE OF THE NUCLEUS SCHEME

The nature of PIRs being implemented in the villages varies greatly, so there is a need to evaluate the financial performance of the PIR. An analysis of the financial performance of the PIRs in Lampung was carried out for PT GGLC and PT TIPPINDO. The PIR from PT GGLC uses two-year old feeder cattle with an average body weight of 250 ± 28 kg. All cattle are fed mixed concentrate and pineapple waste sent by the company to the farmers at two-weekly intervals. The amount of feed offered (on an air dry basis) is about 2 to 3 percent of body weight. Concentrate and pineapple waste are mixed together before being offered to the animals and feed is offered one or two times a day. Each animal receives as much as 30 to 50 kg pineapple waste and 2 to 3.5 kg concentrate per day.

Total production cost in the credit PIR was Rp. 2 799 138 per farmer per period, while the SS-PIR spent Rp. 6 580 120 per farmer per period. Apparently 77 or 78 percent of this total production cost was for buying the feeder cattle. The second largest part of the total cost (12.1 percent) was the feed component for both credit PIR and SS-PIR. Expenses for concentrate dominated the variable cost (6.8 percent for SS-PIR and 7.4 percent for the credit PIR), while the cost of pineapple waste reached 5.3 percent in the SS-PIR and 4.7 percent for the credit PIR.

The calculation of loss and benefit values shows that the farmers in the SS-PIR arrangement get Rp. 1 086 233 per head per period. This is higher than the profit of Rp. 984 328 per head per period made by farmers in the credit PIR. The profit difference arises because SS-PIR farmers bought the feeder cattle themselves, while for the credit PIR farmers the feeder cattle were bought by the nucleus. In this latter case, the price and animal performance were not as expected by the farmer. In addition, there was a difference in selling price between the SS-PIR and the credit PIR. Farmers in the SS-PIR scheme sold cattle at the higher price of Rp. 2650-3000 per kg of body weight while farmers in the credit PIR scheme sold cattle at Rp. 2500-2800 per kg body weight (Santoso *et al.*, 1995).

For the PIR of PT TIPPINDO, 90 percent of feeder cattle raised by the farmers were imported from Australia, with shipments arriving more than twice a month depending on market demand. The capacity of the feedlot plant was 12 000 head and it was expected to market 100 head per day. The fattening period was between 74 and 90 days with a quarantine period of two weeks. Green corn forage was given *ad lib*, and the forage originated from the nucleus scheme for cattle feed (Feed-PIR). The cattle were fed mixed feed and feed supplemented with molasses as an additional energy source. The body weight gain in this fattening programme was up to 0.8-1.2 kg per head per day.

The farmers who are members of KUDs near the nucleus were involved at first intake for the Feed-PIR. The area in the first stage reached 156 ha with a credit value of Rp. 22 477 000. In the second stage the area was expanded to 761 ha with a credit value of Rp. 73 140 000. The harvest time of the corn leaf is at 70 days, or five times in one year. At the initial stage of collaboration, the farmers earned a profit of Rp. 119 000 per month, if they had two harvests.

CONCLUDING COMMENTS

The PIRs between the nucleus (company) and farmers in the villages have a variety of forms, related to the economic, social and cultural conditions of the farmers. The advantage of the PIR for beef cattle is that better use is made of available resources for the production of beef cattle.

On the other hand, the negative side of this programme is that profit is not equally distributed between the farmer and the nucleus, and farmers accept a higher risk in the production process.

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3. STRENGTHS AND WEAKNESSES OF THE INDONESIAN DAIRY INDUSTRY

Paul Riethmuller and Dominic Smith

Department of Economics, The University of Queensland, Brisbane, Queensland,
Australia

The objective of this chapter is to present opinions on the strengths and weaknesses of the Indonesian dairy industry. These have been gathered from a variety of sources, including Indonesian farmers, officials of dairy co-operatives in Indonesia and officers employed in government and non-government organizations. The purpose of reporting this information is to assist policy makers in the industry to develop appropriate strategies for the future of the industry and to complement results and insights obtained from more formal analyses.

As discussed in Hutabarat *et al.* (1994), the Indonesian dairy industry is based on smallholder farms grouped into co-operatives. Farm size is small, with most farms having no more than 3-4 head of milking cows. The dairy farms are based on confined rearing of cattle with forage grasses being gathered from outside the farm in a “cut and carry” system. This involves the farmer, or agricultural labourers (some of whom may be farmers), cutting and collecting grasses from the farmer’s land, or from along the sides of roads, irrigation ditches, forests or other such places. In the early to mid 1990s there were around 75 000 dairy farms in Indonesia grouped into approximately 200 co-operatives.

Since 1979, the development of the dairy industry has been encouraged by a number of government policies. The most visible of these was a mixing ratio policy that obliged domestic processors to absorb all domestic production at “reasonable” prices. These prices were based upon production costs of processors and the prices of competing products at the retail level. Welfare effects of the mixing ratio policy, now abolished as part of the 1998 IMF reform programme for the Indonesian economy, are discussed in Riethmuller *et al.* (1999).

Despite the rapid increases in farm and cattle numbers, and the growth in domestic milk production, as judged by the standards of countries with economically efficient dairy industries – examples are Australia and New Zealand – the performance of the industry has been weak. Many dairy co-operatives have failed, and others are plagued by problems such as high levels of bad debts and low milk quality.

Moreover, prices have been high. According to Erwidodo and Hasan (1993), domestic prices of dairy products such as powdered milk were at least double border prices in the early 1990s. Participants at all levels of the industry have voiced their desire for the dairy industry in Indonesia to become more competitive in order to meet the challenges that lie ahead. To improve competitiveness, it is important that there be some general consensus on what are the problem areas for the industry. In this way, government and industry will be able to formulate programmes that will be in the best long-term interest of the industry.

This chapter uses three sources of data on strengths and weaknesses of the Indonesian dairy industry: (i) a survey of dairy farmers and co-operatives, (ii) a questionnaire presented to high level officials connected with the dairy industry, and (iii) problems identified by the Directorate General of Livestock Services (DGLS) in West Java. The strengths and weaknesses identified are then compared with the experiences of similar smallholder dairy industries, namely those of Zimbabwe and South Africa. The information presented here is believed to be the first attempt to document the views of industry leaders in Indonesia.

PROBLEMS IDENTIFIED BY DAIRY FARMERS AND CO-OPERATIVES

In July 1995, staff from the Centre for Agro Socio-Economic Research (CASER) and the Department of Economics at The University of Queensland conducted a survey of dairy farmers and co-operatives in East, Central and West Java. Forty-five dairy farmers and 30 co-operatives representing over 15 000 dairy farmers participated in this survey. Different questionnaires were used for the dairy farmers and for the co-operative officials. The main focus of the survey was to collect economic, technical, demographic and socio-economic data for the dairy industry. In addition to the collection of this largely quantitative information, farmers and co-operative officials were asked to nominate what they thought were the main problems that they believed confronted dairy farming. This method of identifying the problems and opportunities faced by smallholder farmers owes much to the “farmer-first” approach advocated by Chambers *et al.* (1989) and also to the Participatory Rural Appraisal (PRA) techniques favoured by the Intermediate Technology Development Group. Both these approaches are based on the principle that local people best know their own situation, understand their problems and often have a good idea of possible solutions (Young, 1992).

Table 3.1 lists the major problems identified by farmers and co-operative officials during the course of the survey.

Table 3.1. Constraints identified by smallholder farmers and co-operative officials

Constraint	Sub-classification
Nutrition	Availability of forage grasses
	Lack of water
	Quality of concentrates
	Nutritional management
Herd record keeping	Low level of herd improvement
	Non identification of animal health problems
	Poor reproductive performance
Hygiene	Lack of water
	Increase in mastitis incidence
	High level of milk contamination
Milk testing	No clear price signals to farmers
Animal health	Many diseases
	Lack of resources for veterinary staff
	Lack of experience and education
Genetics	Inappropriate genotype for Indonesian conditions
	Long calving intervals
Extension provision	Lack of resources to train or provide extension workers

Source: Farmer and co-operative surveys

As is clear from Table 3.1, participants at this level of the industry identified many constraints faced by dairy farmers. Many of the problems they identified have been discussed by other authors. For example the importance of water availability to the Indonesian dairy industry has been discussed by Lewin *et al.* (1992). They report that during a survey of 200 dairy farmers in Central Java, lack of water was the second most frequently cited problem. Similarly, during fieldwork in Java conducted by the authors in July 1995, water availability in the dry season was frequently mentioned as a problem by officials of dairy co-operatives. UNESCO has estimated that dairy cattle in the tropics have a daily water requirement of around 13 percent of body weight. For average Indonesian dairy farms this equates to a requirement of around 50 L per head per day. This is for animal consumption alone. Water is also important for maintaining hygiene at the farm level.

A number of the problems identified above are interrelated. One common thread is the lack of adequate extension services. The smallholder dairy industry is largely based on farmers who have had little or no prior experience in livestock management. Once they have been supplied

with cattle (frequently expensive imported heifers)¹ there appears to be little or no follow-up work to ensure that they are able to cope with difficulties that invariably arise. This lack of adequate extension services is not because of a lack of personnel – de Haan (1992) has estimated that there are at least 29 000 extension workers in Indonesia – or because of a lack of ability on the part of workers, but appears to be because of a lack of resources to provide the service to the more than 75 000 farmers in the dairy industry.

Solutions to many identified problems could perhaps be delivered by a large-scale extension project. The emphasis of such a project would vary from co-operative to co-operative, depending upon the particular set of problems identified by the participants in that area. According to JICA (1995), the potential gains from such a project could be large. In a pilot extension programme undertaken in 1992 with six Javanese dairy co-operatives, improvements in technique of over 50 percent were achieved after only two extension visits at each co-operative. This can be compared with average improvements in technique reported by Chamala and Keith (1993) in South East Asia as a result of various methods of extension delivery. These ranged from a low of 19 percent for indirect influence to a high of 33 percent for group sessions.

WEAKNESSES IDENTIFIED BY THE DIRECTORATE GENERAL OF LIVESTOCK SERVICES

Soehadji (1992) reports that the Directorate General of Livestock Services (DGLS) has major areas of concern with the dairy industry in the following categories:

- feeding management and quality;
- reproduction problems and long calving intervals;
- mastitis;
- quality of milk;
- farm management.

The DGLS in West Java (1996) has expanded on these broad areas of concern to provide details of specific perceived problems in West Javanese dairy farms. These are summarized in Table 3.2.

¹ Imported heifers at the time of the survey cost approximately A\$ 2 000 (Rp. 3 700 000), or roughly three times the average annual income in Indonesia. The cost of an imported heifer is roughly eight times the average annual family income from a typical dairy farm.

Table 3.2. Problems identified in the West Javanese dairy sector

Problem area	Perceived problem
Farmer	Farm size too small Lack of expertise Incorrect drug application
Dairy cattle	High calf mortality Reproductive disorders Mastitis Brucellosis Tuberculosis High calving interval High services per conception
Animal nutrition	Pesticide residues Lack of available land Seasonal nature of feed production
Milk processing	Poor quality of milk Lack of technology applicable to the village
Marketing systems	Highly variable price Dependence on IPS

Source: DGLS West Java (1996).

The conclusion reached by the DGLS in its report was that much progress had already been made in solving these perceived problems, but that many planned future activities would require massive investment from the public and private sectors.

OPINIONS OF DAIRY INDUSTRY OFFICIALS

In January 1996 a seminar on the Indonesian dairy industry was held in Bogor, Indonesia. Participants in the seminar included officials of many organizations associated with the Indonesian dairy industry. These included officials of GKSI, DGLS, CASER, the Ministry of Agriculture, dairy co-operatives and milk processors.

During the course of the seminar, participants were asked to nominate what they considered to be the strengths and weaknesses of the Indonesian dairy industry, and to give their opinions on the major problems facing the dairy industry. Tables 3.3 and 3.4 show the respondents' opinions about the problems and weaknesses.

Table 3.3. Opinions on problems facing the Indonesian dairy industry, January 1996

Problem classification	Problem	No. of respondents
On-farm	Farm level efficiency	4
	Low level of technology	2
	Genetics	2
	Cost of feed	2
	Lack of forage land	2
	Milk quality	2
	Resources	1
	High level of capital needed	1
	Small scale of farms	1
	Feed availability	1
	Off-farm	Co-operative management
Lack of incentive		2
Marketing		1
Institutional constraints		1
Monopoly of processors		1
High price of milk		1
Distribution of imported cattle		1
Credit dispersal		1

Source: Survey of seminar participants

Table 3.4. Opinions on weaknesses of the Indonesian dairy industry, January 1996

Weakness classification	Weakness	No. of respondents
On-farm	Low level of technology	3
	Low level of farm efficiency	3
	Low level of expertise	2
	Small scale of farms	2
	Animal health	1
	Feed availability	1
	Milk quality	1
	Climatic adaptation	1
	Low farmer incomes	1
	Off-farm	Relationship between farmers and co-operatives
Corruption within co-operatives		2
Marketing		2
Management of co-operatives		2
Transport infrastructure		1
Bad planning		1
No marketing boards		1
Extension		1
Price signals	1	

Source: Survey of seminar participants

As shown by Tables 3.3 and 3.4 there is a wide range of perceived problems within the Indonesian dairy industry. The responses in Tables 3.3 and 3.4 were obtained from 12 officials. Even this small number of respondents managed to identify 18 different problems and weaknesses.

The same officials were asked to nominate what they considered to be the main strengths of the Indonesian dairy industry. The results are presented in Table 3.5.

Table 3.5. Opinions on strengths of the Indonesian dairy industry, January 1996

Strength	Number of respondents
High level of potential demand	12
Support from government policies	4
Provides rural employment	3
Availability of natural resources	2
Based on smallholder farms	2
High level of farmer interest	1
Climatic suitability	1

Source: Survey of seminar participants

The opinions of the respondents as to the strengths of the Indonesian dairy industry are of interest. The two most frequently cited strengths are the potential future demand levels for dairy products in Indonesia and the government policies that support the dairy industry. These two “strengths” are exogenous to the dairy industry itself. They reflect characteristics of the environment in which the dairy industry operates. It is true that there is a large potential demand for dairy products in Indonesia and that there is likely to be a strong demand well into the future. An analysis conducted by Somantri (1984) using household survey data provided income elasticity estimates ranging from 0.503 (for high income households) to 2.7 (for low income households). Other elasticity estimates reported by Somantri were 2.44, 1.65 and 1.99 for growth in Indonesia and 2.58 for ASEAN. When these estimates are combined with income growth that Indonesia is likely to experience in the future, it can be seen that substantial increases in dairy consumption may well occur. With the removal of the mixing ratio regulation and the move towards less protection for the dairy industry, it is likely that a large portion of the potential market will be taken by foreign suppliers. The finding that government policies are regarded as a strength of the industry by four of the 12 respondents is not surprising. The reason for this is that these respondents may well be involved in the administration of the policies, giving them a vested interest in ensuring the policies are seen in a favourable light.

Some of the strengths cited are endogenous to the industry. These include the provision of rural employment and the small-scale nature of the industry. It is interesting to note that the respondent who identified the smallholder nature of the dairy industry as a strength also identified the small-scale of dairy farms as a weakness.

OPINIONS FROM A SIMILAR INDUSTRY: SMALLHOLDER DAIRYING IN SOUTHERN AFRICA

The smallholder dairy industries of Zimbabwe and South Africa were chosen for comparison with the Indonesian experience because there are a number of similarities between the industries. All three industries are based upon the use of temperate breeds of cattle in the tropics (Friesian and Jersey); all are based on confined rearing; herd sizes are similar; climatic conditions are somewhat similar; and all three industries have been faced with productivity and quality problems.

Kadzere (1992) used data gathered in a survey of 36 dairy farms in Zimbabwe and South Africa and assessed the major problems faced by the participants. The results are summarized in Table 3.6.

Table 3.6. Problems faced in southern Africa's dairy industry

Identified problem area	Specific problems
Animal breeding	No tropical breeds used Need to develop appropriate characteristics based on criteria of Vissac (1976)
Nutrition	Seasonal nature of forage production Poor nutritional quality of available forage No legumes used
Herd recording	Lack of usable animal production records
Size of herd	Small herd sizes mean that returns to scale are not achieved
Extension availability	Lack of available extension resources

Source: Kadzere (1992)

It is apparent that the problems identified by southern African smallholder dairy farmers correspond quite closely to those identified by Indonesian smallholders. This suggests that introducing an industry such as dairying, with its relatively high requirements for capital and managerial expertise on the part of the dairy farmer, is a difficult task in a developing country.

CONCLUDING COMMENTS

The information presented in this paper is a useful starting point for policy makers who are contemplating the design of programmes and policies aimed at improving the dairy industry in Indonesia. A prerequisite for the formulation of the most cost-effective solutions is the correct identification of the problems. In the case of the Indonesian dairy industry, an important priority of research should be to determine the relative importance of various

problem areas at the individual co-operative level². In this way, effective policies and advice can be designed for the industry. Any assistance given should conform with the views of Wilson *et al.* (1992). They proposed that solutions should have a high likelihood of sustainability, should reach the participants who are most in need, should use local knowledge, and should be effective in raising farmer incomes. It is unlikely that any single solution would work in all areas of Indonesia where dairying takes place. Instead, specific programmes should be tailored to meet the requirements of particular locations.

A finding that was perhaps surprising was that no mention was made of negative externalities associated with the dairy industry, the most important of which are environmental problems. In those high income countries with large dairy industries and a relatively small land area – for example, the Netherlands, Japan and, to some extent, New Zealand – environmental considerations are given a high priority by policy makers. With Java's population density being one of the highest in the world, environmental costs should be given higher weighting. The fact that this issue was not mentioned in the survey may reflect the affiliation of the respondents with the dairy industry rather than the importance of this particular issue.

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² Some areas identified by seminar participants as important for future research assistance: identification of appropriate extension strategies; dairy product marketing; appropriate on-farm technology; genetic improvement; provision of credit; optimal level of scale; optimal dairy cattle breed; quality and price of concentrates.

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4. LOCAL LIVESTOCK FEED RESOURCES

Andi Djajanegara

Research Institute for Animal Production, P.O. Box 221, Bogor 16002, Indonesia

The agricultural sector in Indonesia is expected to follow the trend to industrialization, and the production of livestock is expected to be a new area of growth. The development will entail a major shift in orientation, from production to income generation and from a commodity approach to an agribusiness approach, as the demand for meat, milk and eggs increases with population, rising incomes and changes in consumption patterns. The present agricultural development policy focuses on a more efficient use of natural resources for a sustainable environment and is aimed at increasing farmers' welfare. The economic problems that have been facing Indonesia have led policy-makers to encourage farmers to take advantage of locally available resources because imports of livestock products and feed ingredients will not be feasible. With a population of over 200 million that is still growing, there is no doubt that agricultural products will have a market in the future.

Indonesia has a tropical environment with daily temperatures in the range 23-31°C in the low plains and 18-27°C in the highland areas. However, it is the variable rainfall pattern rather than temperature that determines the agricultural systems. Arable land for food crop production occupies around 29 million hectares of the 130 million hectares available. It is apparent that food crop production will dominate the agricultural sector, particularly in Java. The use of crop residues has supported the production of livestock for centuries. While still regarded as traditional, the raising of farm animals has been integrated with the production of food crops. Within the intensive but traditional food crop production based on systems such as rice-rice-rice or rice-secondary crop-rice in the one year, one would expect that there would be little opportunity to provide feed for the production of livestock in irrigated areas.

PRESENT LIVESTOCK PRODUCTION

Indonesia, an archipelago of over 13 000 islands covering 5 600 km from east to west and 1 600 km from north to south, has a total land area of around 1 910 000 km². The major islands are Sumatra, Kalimantan, Java, Sulawesi, the Nusa Tenggara Islands, Maluku and Irian Jaya. Of these, Kalimantan is the largest, with about 28 percent of the total land area.

The island of Java is relatively small (6-7 percent of the total land area), but it is the most densely populated in terms of numbers of people and livestock.

On Java, the livestock and poultry represent 70-80 percent of the national livestock population. They are raised in traditional small-scale production systems with 3-4 animals per farm. The animals are generally kept in barns and the income from livestock production provides less than 30 percent of gross farm product. In the poultry business, the raising of the native breed of chicken has been the backbone of the businesses that supply chicken meat and eggs. It is quite common in the production of poultry for farmers to raise only a few hens (less than 10 birds per farm). With such small production units that are also scattered through the country, the distribution of farm inputs and products is important. In contrast, the development of the modern poultry business with improved breeds of chicken has seen the production scale of commercial chicken farms reach 10 000-200 000 birds per farm, starting from the production of day-old chicks that cater for medium and large layer and broiler operations. The poultry industry has developed dramatically in the past decade. However, the 1997 economic crisis severely affected all poultry farms. Many (60-80 percent) were facing bankruptcy in the late 1990s and may not be able to maintain their production levels. The major problem is high feed costs, because the major ingredients in rations, such as fishmeal, soybean meal and corn are imported. The impact of the crisis highlights the importance of using locally available feedstuffs to feed animals.

Increasing demand for beef has stimulated the establishment of large feedlot operations of up to 10 000 head per farm. These farms have relied on imported feeder cattle and consequently they were severely hit by the economic crisis. Similarly, the demand for milk has increased dramatically, but 60 percent of the milk used by the milk processing manufacturers has been imported. Hence, they also face problems. The dairy production system has changed little over the years with almost all dairy farmers being members of dairy co-operatives. Average production is 8-12 L of milk per farm, but with the low price of milk there is no incentive for dairy farmers to improve their production capacity. The price of milk is determined by the dairy co-operative of which the farmer is a member. These collect the milk and distribute it to the processors and consumers.

The production of ducks is becoming a more business-oriented operation. However, it is likely that this industry will also face problems similar to those facing the chicken industry. Raising of ducks has previously been based on a nomadic production system in which the birds are moved around to find feed in recently harvested rice fields.

Cattle, buffaloes, horses, sheep and goats in the eastern islands of Nusa Tenggara and Sulawesi are allowed to graze on vast grassland areas. The low reproductive performance of the animals has often been associated with poor nutrition. However, the relatively low productivity and quality of the forage are a major limitation because the animals are grazed on communal grazing lands. The introduction of improved management practices and the use of improved grass and legume species have had little success in the uncertain management system. Individual farmers do not feel responsible for the management of the grassland areas.

In Sumatra and Kalimantan, thousands of hectares of land are under plantation crops such as rubber and oil palm (Table 4.1). It has been known for years that the cover crop biomass under the trees is a potential fodder source for ruminant animals. Plantation workers who raise cattle are able to cut grass under the trees at regular intervals, but the animals are not allowed to enter the plantation area and those that do are considered pests. Research and development activities in North Sumatra have shown the advantages of an integrated sheep-

estate production operation, in which sheep are allowed to graze under the trees. This has provided an added value to estate land. Consequently, there is at present a growing interest in raising sheep under rubber and oil-palm trees. The demand for breeding animals obviously will increase. However, shortage of supply limits further development of this production system.

Table 4.1. Land use in Sumatra and Kalimantan

Item	Land area (ha)
Housing	5 155 422
Dryland for crops	11 368 507
Grasslands	1 889 399
Ponds	604 720
Fallow land	6 967 938
Woodland	9 555 010
Estate crops	13 835 746
Irrigated rice fields	8 484 687

Source: BPS (1996)

LOCALLY PRODUCED FEED AND ON-FARM PROCESSING

In the traditional subsistence systems, feed is not grown particularly for animals and the amount of feed the animals get is determined by the ability of the farmer to obtain it. This has limited the number of farm animals raised by farmers who do not follow any feeding standards. These farmers' main concern is to keep the animals alive because they provide a source of income when sold. The amount of feed offered is not related to efficiency measures and depends upon the quantity of forage available naturally in the surrounding areas, but this feed is not of a guaranteed quality; nor is its continuity of supply guaranteed. Forage is not commonly produced for ruminant animals because of land ownership restrictions. Hence the farmer is dependent on whatever he can get.

In food crop producing areas, fibrous agricultural residues have become the main feed source for ruminant animals. Materials available for feeding to animals are already in use and this is particularly apparent in densely populated areas with high stocking rates, like Java. Materials that are not fed to animals are generally in supply areas too far from where the animals are raised. To transport the feed material to the animals would result in a price that could discourage its use by low income farmers. An exception is rice straw in Gunung Kidul where 50-60 truck-loads are delivered to farmers (Diwyanto, personal communication).

In agricultural areas, of the important residues available for feeding livestock, rice (*Oryza sativa*) straw is the most abundant. This can be seen in Table 4.2.

Table 4.2. Feed resources and utilization

Name	Product	Utilization	Availability*
Fibrous feeds			
<i>Oryza sativa</i> (Rice)	Straw	Fresh/dried Stored for 3-4 months	36 547 000 t
	Bran	Fresh	
<i>Manihot esculenta</i> (Cassava)	Leaves	Fresh/wilted	10 407 000 t
	Stalks	Fresh/dried	
<i>Zea mays</i> (Corn)	Leaves	Fresh/dried	5 275 000 t
<i>Saccharum officinarum</i> (Sugar cane)	Tops /Leaves	Fresh, out ribbed	83 800 ha
Napier grass	Leaves	Fresh	na
Native grass	Leaves	Fresh/dried	na
<i>Musa paradisiaca</i> (Banana)	Leaves	Fresh	
	Stem	Fresh	2 192 060 t
	Peelings	Fresh	
Carbohydrate Feeds			
<i>Oryza sativa</i>	Bran	Fresh	
	Broken rice	Fresh	
<i>Manihot esculenta</i>	Tuber	Dried	
<i>Zea mays</i>	Grain	Dried	
<i>Saccharum officinarum</i>	Molasses	Fresh	
<i>Cocos nucifera</i> (Coconut)	Cake	Stored	3 246 200 ha
Leguminous feeds			
<i>Leucaena leucocephala</i>	Leaves	Fresh	na
<i>Gliricidia sepium</i>	Leaves	Wilted	na
<i>Calliandra calothyrsus</i>	Leaves	Fresh	na
<i>Glycine maximum</i>	Expeller	Stored	na
<i>Sesbania</i> sp.	Leaves	Fresh	na
Non-conventional feeds			
<i>Hevea</i> (Rubber)	Seeds	Dried	2 540 600 ha
Cocoa (Cacao)	Pods	Dried	336 000 ha
	Peelings	Fresh/Dried	
Oil palm	Palm pressed fibre	-	-
	Palm kernel cake	-	-
	Palm fronds	-	-

Notes: Values in this table are total crop production or land use for conversion purposes. The amount used as feed is unclear; na = not available.

Source: Adapted from Rangkuti and Djajanegara (1995).

The main problem in feeding rice straw, apart from collection problems, is its low nutritive value. Hence, if rice straw is fed as basal roughage the animals require additional good quality feedstuff or concentrates to reach a higher production performance. The common agro-industrial products used as sources of concentrates are rice bran, soybean meal, peanut meal, tahu waste, cotton and kapok seed meal, wheat pollard, molasses, cassava and legume leaf meal (Table 4.3). These are available in various locations, but their unequal distribution and high price at the farm level limit their use by smallholder farmers. Just as the production of forage is not a general practice, so also the feeding of concentrates to animals is not carried out except by dairy farmers and commercial feedlots. Smallholder farmers generally do not have the financial capacity to feed concentrates to animals. Although there are cases in which

good quality feed is provided in amounts sufficient for optimal productivity under the traditional livestock production systems, the availability of good quality feed is limited. Agricultural residues are only in abundance at harvest time, making a continuity of supply questionable. The amounts of agricultural products collected by the smallholder farmer are generally only sufficient to cover a short period of the year, and farmers seem to prefer to offer more palatable green roughage such as grass and legumes rather than dry agricultural residues. In certain regions in Java it is already common practice to use rice straw as feed. However, large amounts of the straw are still being used for other purposes.

Table 4.3. Productivity of major food crops in Indonesia

Item	Harvested area	Production	Average production
	(000 ha)	(kt)	(t/ha)
Rice	11 519	50 575	4.39
Corn	3 680	9 142	2.495
Cassava	1 406	16 910	12.0
Sweet potato	213	2 029	9.5
Peanut	696	746	1.072
Soybean	1 276	1 510	1.183

Source: BPS (1996)

Straw contributes 60 percent of available residues, while sugar cane top, bagasse and maize products contribute less than 10 percent. Sugar cane tops are fed to animals while the bagasse is normally used as fuel in the sugar mill. Only at the time of the sugar cane harvest are animals fed on sugar cane tops, because this is when farmers and plantation workers around the sugarcane plantations have access to the cane tops. Once these have been taken from the field and the rinds have been removed, the tops are offered to the animals. Molasses, a by-product of the sugar industry, is primarily used in the production of spirits, monosodium glutamate and amino acids. Molasses is therefore not commonly fed to farm animals except horses. The inclusion of molasses in the rations of animals is known to improve feed palatability, and molasses is a source of readily fermentable carbohydrate and sulphur in the making of urea molasses blocks. Molasses is a potential ingredient of feed pellets because of its binding properties. Up to 30 percent could be included as part of the mixture used to make pellets.

From the nutritional point of view, corn stover or corn cob appears the most attractive source of roughage for ruminants. Partnership-style operations between feedlots and corn farmers have been set up, in which corn farmers supply corn stover to the feedlots.

In the poultry business, the use of corn, soybean meal and fishmeal as basic ingredients in the ration has been generally recommended, but this has been a disaster because of the high cost of imported feed ingredients. With the drop in the exchange rate of the rupiah against the dollar, the use of imported feed ingredients in mixed feeds is no longer feasible. The price ratio between feed and livestock products that at one time favoured livestock producers has not been maintained. And sometimes the negative impact of using imported feed ingredients has been overlooked.

If locally available feedstuffs are to be used as substitutes for imported feeds, cassava (*Manihot esculenta*) would need to be relied on, despite its low protein quality. It may be possible to use protein enrichment technology where cassava is used as a base material. Treatment of carbohydrate-rich feed has shown that it is possible to increase protein content from 3-4 percent to 20-40 percent in a solid state fermentation process using *Aspergillus niger* (Kompang *et al.*, 1994). Cassava is one of the richest starch producing plants of the tropics and when the roots are dried it is offered to animals in the form of cassava chips. Indonesia produces over 6 million tonnes per year and over 1 million tonnes are exported despite the problems of fungal growth and cyanide content. The use of cassava chips in Indonesia has not been popular because other feed ingredients are available. Under present conditions, the use of cassava as a locally produced feed source requires the provision of protein rich materials and vitamin A supplements. Aflatoxin problems have not been reported and the toxin is generally not detected in cassava chips. T² toxin can be detected in cassava chips at concentrations below the level of 0.32-0.64 mg per kg and this is reported to cause enteritis to ruminants (Lynch, 1979). The leaves of cassava are already extensively used to feed animals and are abundant at harvest time. Sudaryanto *et al.* (1983) investigated the method of harvesting of cassava leaves. It was found that if 15 leaves were left at the top of the cassava plant there was no effect on the cassava root. The major aim of this research was to determine whether it is possible to produce cassava leaves throughout the year for a year round supply of leaf material. *Leucaena leucocephala* is a natural tropical legume that produces leaf meal with a reasonably high protein content of 16-17 percent. Poultry feed manufacturers use leucaena leaf meal mainly as source of pigment. The introduction of the Hawaiian giant leucaena cultivar to preserve forest areas has increased the production of leucaena leaves. However, problems with psyllid (jumping lice) a decade ago limited its production. By-products from pineapple canning factories have been used for feeding animals in Lampung. Residues from pineapple canning have been fed to cattle in feedlot operations. Neighbouring farmers have the opportunity to use the products through a collaborative arrangement with the canning industry.

Of the many concentrate feeds, rice bran is an agro-industrial by-product that is of limited value for human consumption. It contains the aleurone layer, endosperm, scutellum and germ of rice. Rice bran is the most important feed ingredient locally available and this is due to the fact that it is in abundance and contains a reasonably high (12 percent) protein level with a fat content of around 15 percent. The limitation of using rice bran as a concentrate feed is that the high fat content causes rancidity because the fat is readily hydrolysed and may affect calcium balance. In addition, inclusion of hulls is a problem associated with the poor milling facilities at village level and manipulation of rice bran quality. Feeding of rice bran to animals is a common practice after the rice products have been milled. Those rice farmers who have no animals leave the bran at the rice mill as part payment for the rice being milled.

Wheat by-products, in the form of pollard and bran, are available and are a major feed component in rations for poultry and dairy cattle. Dairy co-operatives and poultry feed mills obtain wheat pollard from the one factory that produces wheat flour. A small proportion is also exported. Because only one company is involved in milling wheat, the quality of wheat pollard and bran is consistent.

Coconut meal is another by-product that is sometimes exported. It has been extensively used in poultry and dairy cattle rations in Indonesia. Copra, the dried form of coconut, is not commonly used as feed. The major problems with coconut meal are its oil content – it easily

becomes rancid – and the presence of mycotoxins. These lower the value of the coconut meal produced in Indonesia.

A feed ingredient that is available in the villages of Central and East Java in small quantities is kapok seed meal. Kapok seed is used in the production of kapok oil for export and the meal contains a high protein content (25 percent). The fat content is high (8-10 percent) and this is due to the poor extraction process. Kapok seed meal is believed to contain components that are toxic to monogastrics; these are reported to be degraded in the rumen, making them non-toxic to ruminants.

PRETREATMENT OF FIBROUS AGRICULTURAL RESIDUES AND CONSTRAINTS TO THEIR ADOPTION BY FARMERS

For sustainable livestock production systems, in particular large ruminants, land use planning is important. A firm land use plan for livestock production needs to be established. At present, a problem is that livestock operations often have to be moved to other areas when land use priorities change; for example, the land is taken over for community development, food crop production and industrial crops.

For agricultural residues such as corn stover, sugar cane tops and cassava leaves there is the problem of continuous supply because these are only available during harvest, which is often once a year. Storage of the material also creates problems because of space and transport limitations. Forage products that have a high moisture content (over 30 percent) cannot be safely stored without special treatment. In the humid tropical conditions, spoilage due to microorganisms is a problem. In the field, sun drying is common and inexpensive, but the quality of the dried product is uncertain. In addition, during the rainy season, sun drying is not possible because of the unpredictable rainfall pattern. The agroecology and processing methods vary, so the agricultural residues have very variable quality, making it difficult to formulate feed rations with them. The low protein and energy contents of fibrous agricultural residues make additional feed supplements necessary. Most fibrous agricultural residues are bulky and this creates problems when they are transported for further processing in feed mills or when they are pelleted. Pretreatment, for instance physical pretreatment such as pressing, increases the density of the residues and will improve the feed intake of animals. However, the cost of processing may limit its application.

The various pretreatment technologies available to improve the nutritive value of fibrous agricultural by-products – in particular straw – have so far not been practised by farmers (Ibrahim, 1983; Doyle *et al.*, 1986). While it is evident that technologies for improving straw quality have been successful in breaking the ligno-cellulose complexes, Djajanegara (1988) reported that the benefit of urea pretreatment of rice straw could also be achieved by infusing similar amounts of urea into the rumen.

Feeding pretreated rice straw can only meet the maintenance requirement of the animals. Hence, although the treatment would increase straw intake and digestion, the use of supplementary feeds is important for achieving higher production levels. The only advantage, but an important one, of pretreatment of straw to support maintenance requirement is that it results in a significant reduction in weight loss. The use of alkali treatment with NaOH and urea (4 percent urea to straw dry matter) was introduced to farmers in the early 1980s but the adoption of the technology has been rather poor.

The microbial pretreatment technology of preserving roughage through ensiling has been known for decades. The technology has been introduced to farmers but appears to have never been completely implemented by small farmers. To speed up the process of ensiling at the initial stages, a commercial inoculant is available in the market. It contains the lactic-acid-producing bacteria *Lactobacillus plantarum* (Anonymous, 1992). Other microbial pretreatments have been identified, but contamination by other microbes under field conditions cannot be avoided. Research efforts have now focused on finding microbial compounds that improve the digestibility of low quality roughage. A process has been investigated for selecting microbial populations that have adapted to low quality fibrous substrates. Increased weight gain of cattle was reported when they were fed the preparation once in three months. However, in these experiments, the animals had been fed on high concentrate rations.

A different approach to the use of microbially treated rice straw involved a mixture of microbial compounds used by one farmer in Central Java, (Suharto, 1997). The straw was treated in an aerobic environment and the material was fed to animals after being milled. The compound (commercial brand Starbio) was claimed to reduce odour pollution in livestock farms. Better weight gains were also obtained when the treated straw was fed to cattle. The material is now being introduced in Bali and in other parts of Indonesia.

The reasons that have been offered for farmers not using pretreated fibrous agricultural residues include:

- the relatively small amount of straw collected to feed animals;
- a lack of storage facilities;
- the additional costs of treating the straw; and
- the need for a redrying process and for labour.

Lack of storage facilities and labour during harvest time are major reasons for only a small amount of straw being collected. At harvest, farmers are busy caring for the recently harvested rice. The production of rice by the small land owners does not encourage mechanization because it is not feasible for smallholders, most of whom are poor. It is also apparent that farmers prefer to feed their animals on the other feeds available, such as fresh roadside grass which is more palatable than straw. The distance the straw has to be carried to the animals with the present infrastructure discourages collection of all the available straw. Djajanegara (1981) reported that the collection of one tonne of wet straw, which is a relatively small quantity, took nine man-days during the rice harvesting season.

Alternative uses of rice straw are probably more convenient. These include burning, which results in its use as a fertilizer in paddy fields, or its sale to other users. Other users include vegetable producers who use the straw for mulching, mushroom growers who use it as substrate, the producers of single cell proteins through acid hydrolysis producing sugars, livestock and poultry farmers who use the straw for bedding material, paper manufacturers who use it as a source of fibre and construction materials, and those who use it as fuel to produce heat. No data are available on the proportion of straw put to these uses.

It should be noted that rice farmers in Central and East Java keep straw to feed animals. Feed is generally scarce when the rice fields have been planted with rice crops and so the straw becomes the prime feed available when green roughage cannot be found. The straw used is generally stored for three to six months. It is most probable that the nutritive value of the straw improves during storage.

In irrigated rice fields, the availability of water allows farmers to immediately replant the land for the next planting season. If irrigation is not possible, particularly during the dry season, the uncultivated rice fields become excellent grassland areas for cattle, and the condition of these animals generally improves. Collection of forages could take place 10-20 km away from the farm, but the amount collected by one farmer in one day would only be sufficient to meet the animals' requirements for one to two days.

The implementation of pretreatment techniques is not popular since the relatively small amount of straw being collected can be fed to the animals for only a short period. One tonne of straw will only provide feed for about 50 days if the farmer has 2 head of cattle. Sheep and goat farmers do not feed straw to their animals. When collection of feed becomes a burden to the farmer, the selling of animals is the last resort to meet household financial needs.

FUTURE SCOPE

In looking to the future, there may be opportunities to produce local feed ingredients in an agribusiness setting. It may be possible to produce complete mixed rations for ruminant animals that include fibrous feed materials. The challenge for large-scale feed milling operations will be to do this economically and to distribute the feed. There is always the opportunity to export a complete feed mix to neighbouring countries which also face the pressure of limited land resources. In this regard, Indonesia has the land resources in its less populated islands such as Sumatra, Kalimantan and Irian Jaya. For small-scale operations, under a co-operative scheme, production could be managed by co-operatives that are equipped with a small processing unit. Individual farmers who raise only a small number of cattle or sheep and goats could join the farmers' co-operative in the distribution of the feed.

Integrated production schemes are an interesting possibility, in an Integrated Livestock-Estate-Crop Production Systems (ILEPS) approach. The vast plantation areas found in Indonesia, where the biomass growing under the estate trees provides excellent forage resources, could potentially be involved in such a scheme (Table 4.4).

The use of residues from pineapple canning is a good example of how to produce feed for ruminants from local materials. Results from rubber plantation areas in North Sumatra where sheep are raised under rubber trees suggest this could also become a promising production system. The animals can use the forage biomass that has been regarded as weeds by the plantation operations. This material is an excellent forage resource for ruminant animals. The shading provided by the trees also protects the animals from problems associated with heat stress. In the oil palm plantation areas, apart from the undergrowth, the supply of fibrous residues is abundant. The palm pressed fibre can be used, and the palm fronds (leaves and petiole) have been found to contain 15 percent protein. When these were fed to cattle, the animals gained close to 900 g per day. In the vast plantation areas, there is wide scope for producing local feed materials. For a feed mill operation, the problem of distribution may not present a big problem as long as the selling price is right for farmers. From the processing of estate crop products, residues such as palm kernel cake could also be fed to animals in limited amounts.

Table 4.4. Planted land area and production of estate crops, Indonesia

Crops	Large estates			Smallholder estates	
	Number	Planted area (000 ha)	Production (kt)	Planted area (000 ha)	Production (kt)
Perennial crops					
Rubber	465	538.3	334.6	2 942.0	1 178.6
Coconut	265	137.6	52.8	3 584.0	2 651.2
Oil palm	457	1 146.3	2 569.5	722.5	1 105.9
Coffee	157	46.7	26.5	1 099.7	440.2
Cocoa	280	129.6	47.0	416.4	202.1
Tea	127	61.5	80.1	62.1*	36.6*
Kapok	24	6.4	0.4	278.7	69.3
Cinchona	7	2.2			
Annual crops					
Tobacco	23	4.3	7.1	196.6	133.6
Sugar cane	72	400.0	2 160.1		
Rami/Rosella	13	6.9	4.9		

Notes: *12% of land area can be used for grazing

Source: BPS (1996)

For the future, the use of local feed resources has great potential and needs to be explored. There are ample opportunities because of the ever growing demand for animal products in the region and in the world. It is vital that the importance of feeding good quality rations in sufficient amounts to farm animals be recognized, to achieve optimum production rates.

Over the centuries, smallholder farmers have used feed materials found within the surrounding areas. That production system could be regarded as a no-cost feeding system. Hence, to compete with this type of production is a challenge. Almost all available feed materials have been used by smallholder farmers. However, there must be changes as the pressure increases to use land resources more efficiently. Farm animals need to have access to a sufficient and continuously available feed supply if they are to achieve a reasonably high production performance.

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5. THE TRANSPORT OF LIVESTOCK, LIVESTOCK PRODUCTS AND FEED IN INDONESIA

Argono R. Setioko and Yulvian Sani

Central Research Institute for Animal Sciences (CRIAS), Jl. Raya Pajajaran,
Bogor 16151, Indonesia

Livestock in Indonesia is very much a part of the farming system, and in some provinces livestock-based agribusiness enterprises contribute significantly to the provincial economy. Improved income levels and changing food habits are driving an increasing demand for livestock products. Future demand for livestock products must be supplied through either domestic production or imports. Smallholders' production alone cannot be expected to meet demand, and alternative production systems must be developed.

Improvements are required in the infrastructure used in the transport and handling of cattle, especially in the eastern islands of South and Southeast Sulawesi, Nusa Tenggara Timur and Nusa Tenggara Barat. These provinces currently supply a large part of this market. A good transport system for feedstuffs, livestock and animal products could improve the distribution of materials.

The main objectives of this chapter are to present information on the transport systems operating in the livestock industry. These include the transport of feedstuffs to Indonesia; the transport of animal feeds from the feed milling industry to users; the transport of live animals to the processing plants; and the transport of end products to the consumers or retail outlets. Since Indonesia is made up of more than 13 000 islands spanning about 5 000 km from east to west, information is also presented about inter-island shipping of livestock.

TRANSPORT OF FEEDSTUFFS TO INDONESIA

The commercial feed industry has grown in parallel with the development of the egg industry and the poultry meat industry. Both of these industries make use of hybrid chickens. About 90 percent of the output of the feed industry goes to the poultry industry, with the remainder being used in the pork, dairy, duck, fish and shrimp industries. The poultry industry is at present located around five cities: Jakarta, Bandung, Semarang, Surabaya (all these cities are

in Java) and Medan (in Sumatra). In 1996, the production of poultry feed had increased to 6 500 000 t, only to fall to 2 500 000 t in 1998 due to the economic crisis in Asia. About 60 percent of corn, 90 percent of fishmeal and 100 percent of soybean meal are imported. Whole rice bran and pollard are locally available.

There are 63 feed manufacturers in Indonesia and these are mainly located in Java and Sumatra (see Table 5.1).

Table 5.1. Location and number of feed manufacturers in Indonesia, 1997

Provinces	Numbers
DKI Jakarta	4
West Java	18
Central Java	8
East Java	16
North Sumatra	10
South Sumatra	1
Lampung	5
South Sulawesi	1
Total	63

In the past, the import of soybean and fishmeal was undertaken by the National Logistic Organization (BULOG), an agency of the Government of Indonesia. However, from 1995, BULOG lost its role as a controlling agent for importing feedstuffs, allowing private companies to freely import feed ingredients. Most soybean meal is imported from the United States, Brazil, Argentine, and India. Imports of soybean in 1997 totalled 830 000 t, valued at US\$260 million (Table 5.2).

Ships used to transport feedstuffs are classified as either large carriers (normally called “Panamac” ships) or small carriers known as “Handy” ships. The former group have a capacity of approximately 55 000-60 000 t while the latter group have a capacity of about 25 000-30 000 t. Ownership of these carriers is usually in the hands of non-Indonesians, but there are some ships owned by Indonesians. Jakarta, Surabaya, Gresik, Cilacap and Semarang are major ports in Java that are able to unload small carriers, and Medan and Panjang (in Sumatra) also. All these ports are controlled by the government. Most imports of feed grains come through Jakarta and Surabaya. One port capable of handling large bulk carriers is Serang, located 60 km east of Jakarta and also called Cigading. It belongs to a private company, PT Krakatau Steel. The port is used to unload feed grain, especially from large carriers with 60 000 t capacity. Most ports operate year round, except for Cigading Port. The government has spent millions of rupiah on improving or upgrading the port facilities.

At present in Indonesia there is no port with facilities for the automatic loading or unloading of grains (“pelabuhan curah”), although ports have crane facilities capable of unloading 50 kg bags of feedstuff. Animal feed on the ships is put into 50 kg bags on board by labourers. They are unloaded using the port’s crane facility and usually they are carried by trucks direct to the feed mill. At large feed mills, most corn and soybean is stored in upright silos. The cost of

delivering animal feed from ports to feed mills varies from Rp. 30 to Rp. 50 per kg, depending on the distance. That cost includes handling, transport and import document clearance.

Table 5.2. The values and quantities of imported feed ingredients and their countries of origin, 1997

Imported feedstuff	Quantity	Value	Country of origin
	(t)	(US\$000)	
Hydrolyzed feather meal (HFM)	25 288	10 661	Australia, USA, UK, Italy
Corn gluten meal (CGM)	75 111	33 666	India, USA, Australia
Meat bone meal (MBM)	164 751	62 475	NZ, Australia, USA, Italy, Peru, Canada
Soybean meal (SBM)	829 930	259 527	India, Brazil, Argentina, USA
Canola meal pellets (CMP)	31 750	6 615	Canada
Wheat pollard/bran (WP/B)	63	38	USA
Meat meal (MM)	6 280	2 596	NZ, Peru, USA, Chile
Fishmeal (FM)	48 686	31 527	NZ, Peru, USA, Chile
Poultry by-product meal (PBPM)	18 792	8 757	USA
Poultry meat meal (PMM)	7 136	3 547	UK
Defatted meat meal (DMM)	2 450	1 066	Italy, France
Rapeseed meal extract (PME)	97 097	13 696	India
Groundnut meal extract (GME)	30 787	6 482	India
SM.-300	36	30	France
Yellow maize/corn (YM/C)	79 007	14 345	Argentina, China
Poultry protein meal (PPM)	1 000	455	USA
Vegetable protein (VP)	28	26	USA
Squid liver powder (SQLP)	149	64	Australia, USA, South Korea
Canary seed (CS)	63 957	22 385	Canada
Fish oil (FO)	36 713	23 083	New Zealand, Peru
Hypro soy meal pellets (HSM)	63 000	21 152	Argentina, Brazil
Brown flax seed (BFS)	120	54	Canada
Sesame seed meal (SSM)	550	142	India
Hypro sunflower seed extr (HSSE)	2 420	496	Argentina
Scallop liver powder (SCLP)	54	68	Japan
Skimmed milk powder replacer (SMPR)	19	12	Netherlands
Blood meal (BM)	160	640	New Zealand
Oats	9	2	Australia
Feed barley	8	2	Australia
Fish soluble (FS)	18	13	Taiwan
Sunflower meal (SFM)	3 300	462	India
Poultry grease (PG)	1 050	509	USA
Soybean lecithin (SL)	15	13	USA
Krill meal (KM)	5	8	Ukraine
Rice bran extract (RBE)	6 767	623	India
Total	1 596 506	525 237	

THE TRANSPORT OF ANIMAL FEED BETWEEN DIFFERENT ISLANDS

Large mills acquire the major domestic ingredients such as corn, copra meal, and rice bran through agents. The fishmeal that is produced by a fish oil plant on the west coast of Bali is mostly used by a large feed mill in Surabaya. Similarly, corn that is readily available in Lampung is transported by ship to Jakarta and other feed mills around the city. Inter-island shipping of animal feed is common.

The price of imported soybean meal, fishmeal and corn tends to be set by the international market and includes transport and handling costs. Ports located in Java have an advantage over those located on other islands because of better facilities. About 70 percent of the feed manufacturers are located in Java. Problems of inter-island transportation arise mainly because of the inconsistency and low frequency of shipping, ship capacity, and the limited number of ships specially designed to transport animal feed. The use of feed containers to carry animal feed on ships is a possible solution but it increases total transport cost.

The role of private sector investment in improving the efficiency of the industry is important. In mid-1998, a special large port for handling feed grains was under construction in Bojonegoro, Serang, 70 km to the south east of Jakarta. This facility is being constructed with the support of the US government. It is here that the shipping of feed grain will be concentrated in the future, since facilities and silos will be available for the automatic loading and unloading of feed grain. When finished, it will be the only modern port for feed grains in Java. There are a series of government regulations that relate to inter-island shipping, especially with regard to the safety of transported animals, disease control and penalties that are imposed by the government. Freight rates and the activities of companies participating in inter-island shipping, on the other hand, are not controlled by government. So far the involvement of the private sector in improving the transport infrastructure has been very limited.

TRANSPORT OF ANIMAL FEED ON THE MAJOR ISLANDS

The feed mills are usually located in the areas where port facilities are available for importing feed ingredients. The location of feed mills is also determined by the availability of local ingredients such as corn and rice bran because these might be the main ingredients for animal feed. About 50 percent of feed ingredients come from corn and about 10-15 percent from rice bran. Most animal feedstuff transported between the major islands is in 50 kg bags. Normally trucks and ferries are used to transport feedstuff from Java to Sumatra, Bali, and Madura islands because of the relatively small distances between those islands and the availability of large ferries to carry trucks. However, transport of animal feed to Kalimantan, Sulawesi and Irian Jaya is by small carriers that belong to local companies. These small carriers usually carry timber from Kalimantan or Sulawesi to Java, and on the return trip they carry feedstuff for the poultry industry. In Java, 90 percent of the feed ingredients are transported by truck, 10 percent goes by ship, and none by train. Deliveries of fishmeal to the factory gate are normally by trucks owned or controlled by the agents. Ingredients such as rice bran and other milling products from factories near the feed mill are collected by the feed mill using its own transport equipment. Feed companies generally rent trucks to carry feed ingredients to the feed mill, as only about 5 percent of feed companies have their own trucks. Large farms use their own trucks to transport feed bought directly from the feed millers. No foreign companies are interested in developing local transport for animal feed in Java.

Special trucks have not been designed for the delivery of animal feed in Indonesia and most of the trucks used in the animal feed industry are also used to carry other commodities. Often these are not particularly involved with the animal feed industry. The trucks vary in capacity. Small trucks, with a capacity of 5 t (locally called “Colt Diesel”), bigger ones with 15 t capacity, or double trucks with a capacity of 30 t are used to transport animal feed. The operating cost of these trucks varies with the distance, and the cost is usually calculated based on weight of load. On average, the cost of transporting feed by truck between Jakarta and Sukabumi (about 60 km) is Rp. 20 per kg, while the cost from Jakarta to East Java (about 800 km distance) is Rp. 60 per kg. There is no special regulation to prevent trucks from operating in different provinces and they operate across the provincial administrative boundaries. All trucks are required to follow the general public transport safety regulations, and have to be inspected regularly every six months by the government road traffic authority for safety against engine and other equipment failure. Old trucks are usually kept for short distance operation because of the risk of engine problems. Before a truck can be operated, the owner must obtain a certificate of clearance from the office of the local road traffic authority (DLLAJR). The owner also needs to pay a fee (“retribution”) to the local district government and other fees during transportation. The overall fee varies from location to location and depends on the size of the truck.

The development and improvement of roads in Indonesia are government responsibilities. For example, in Java where around 60 percent of the population live, a higher priority is placed on road development than in the other islands. The priority attached to road improvement also takes into account the industrial and investment growth of the regions.

TRANSPORT OF LIVE ANIMALS TO THE PROCESSING FACILITIES

Live animals are transported between islands by ship while trucks or trains are used for inter-province movement on a particular island. There is no special carrier for livestock for island-to-island transportation, although the number of live animals transported has been relatively high in recent years. The absence of a particular carrier is due to the variability from one year to the next in the number of animals that are transported, in the timing of the movement of animals, and in their destinations. Data for 1997 indicated that around 180 000 cattle were transported from one island to another using local carriers. Around 500 000 cattle were moved from one province to another in Java by truck or by train, or through the use of ferries to provinces located on other islands. These other islands included Sumatra, Bali and Madura.

Transport of live animals to the local market is the responsibility of small farmers. Over a short distance (less than 10 km), the farmer usually walks the animals. For longer distances (over 10 km), they are normally carried by a truck that belongs to a trader or is hired from another company. Small farmers seldom bring their animals directly to the abattoir. They generally sell their live animals to the traders or butchers and the animals are then taken to the slaughterhouse. There are two types of trucks used to transport cattle or buffaloes to the slaughterhouse. “Fuso” trucks have a capacity of 13-15 head while “Colt Diesel” trucks carry 7-8 head, depending on the size of the animals. The average time spent by animals on trucks varies from two to 24 hours and this depends upon the distance to be travelled. Before slaughter, the animals must be given a rest for at least 12 hours. There is no incentive paid to the truck drivers to deliver animals to the slaughterhouse with little or no bruising or no reduction in weight. However, the driver is penalized when animals are lost or die due to carelessness on the driver’s part. The death of a transported animal is very rare. To reduce

losses from bruising, the number of animals in each shipment is kept low, and the layout of the truck is usually designed in such a way as to minimize losses. The handling involves careful arrangement of the animals especially during loading and unloading, a well designed gangway, and the placement of the animals on the truck to minimize their movement. Small cattle traders usually do not have good facilities. Thus, for them, some bruising at times cannot be avoided.

The government controls the transportation of animals at the borders of the provinces or districts. Government control procedures are concerned with the number of animals being transported, the origin of the animals, enforcement of existing regulations, such as a prohibition on the slaughtering of productive female animals, and the requirement that the animals have a suitable health certificate. When livestock are moved across borders, their owner has to pay a government fee that varies between locations. For example, at the West Java boundary the charge is Rp. 1 500 per head, while at the Lampung boundary, the fee is Rp. 10 000 per head.

A study conducted by Soedjana *et al.* (1993) indicated that live animals transported from Nusa Tenggara Timur to Jakarta make use of four different transportation systems. First, animals are transported from the village to the quarantine area at Teno in Kupang using a small truck – the “Colt Diesel” mentioned earlier – with a capacity of 7-8 animals. They have to stay in the quarantine station for about seven days. Second, the animals are transported from the quarantine area to Kupang Port also using a small truck. Third, they are transported from Kupang Port to Surabaya Port in East Java, using a small carrier equipped with semi-permanent stalls made of bamboo. This facilitates the feeding and watering of the animals during transport. The design of the stalls also takes into account the comfort of animals and is influenced by their size and the carrying capacity of the truck. In East Java, they are kept for at least four hours in the city of Tandes. Finally, the animals are put on a train to Jakarta for the 970 km trip which takes about six hours. On trips such as this, the animals are fed on grasses and straw and given water. The train stops at Cikarang (30 km east of Jakarta), and they are then brought to Tambun for sale in a Bekasi (livestock market). There are some buyers in the market who regularly purchase livestock from Nusa Tenggara Timur. The animals are then taken to a slaughterhouse.

The total cost of transporting livestock is made up of the following:

- a fee at their place of origin;
- the cost of delivery, loading and feeding;
- a charge for the labour involved in looking after animals during travel and their time in quarantine;
- equipment costs such as for rope and bamboo, and animal medicines;
- a fee for the holding yard; and
- a contribution to the Indonesian Association of Livestock Traders (PEPEHANI).

The study by Soedjana *et al.* (1993) reported that transport costs from Kupang (Nusa Tenggara Timur) to Jakarta varies from Rp. 76 000 to Rp. 78 000 for cattle and Rp. 91 000 per head for buffalo, depending on the distance from the village of origin of the animals. Table 5.3 shows the cost of transporting animals from various locations by different types of trucks.

Table 5.3. Average cost of transporting animals from various locations using different truck types

Distance	Type of Truck		
	Fuso (13-15 head) (Rp. per head)	Colt Diesel (7-8 head) (Rp. per head)	Tronton (11-12 head) (Rp. per head)
Sukabumi to Bogor (40 km)	125 000	75 000	
Sukabumi to Bandung (100 km)	200 000	150 000	
Sukabumi to Jakarta (80 km)	175 000	150 000	
East Java to Jakarta (800 km)			600 000
Central Java to Jakarta (450 km)			400 000
Lampung to Jakarta (250 km)			400 000

Source: DGLS (1998)

Madamba (1997) reported that cattle in Nusa Tenggara Timur were slaughtered at sub-district and district level, while some go to the district traders and are then transported to Jakarta. The marketing of cattle and buffalo in Nusa Tenggara Timur is illustrated in Figure 5.1.

The spread of disease is a concern with the movement of cattle from one province to another. There are government regulations that strictly forbid transport of animals from or to locations where an outbreak of disease has occurred. The Livestock Examination Post located at the boundary between provinces is important because its role is to prevent the spread of disease. The future development of cattle transport will emphasize the development of quarantine facilities, especially for imported cattle.

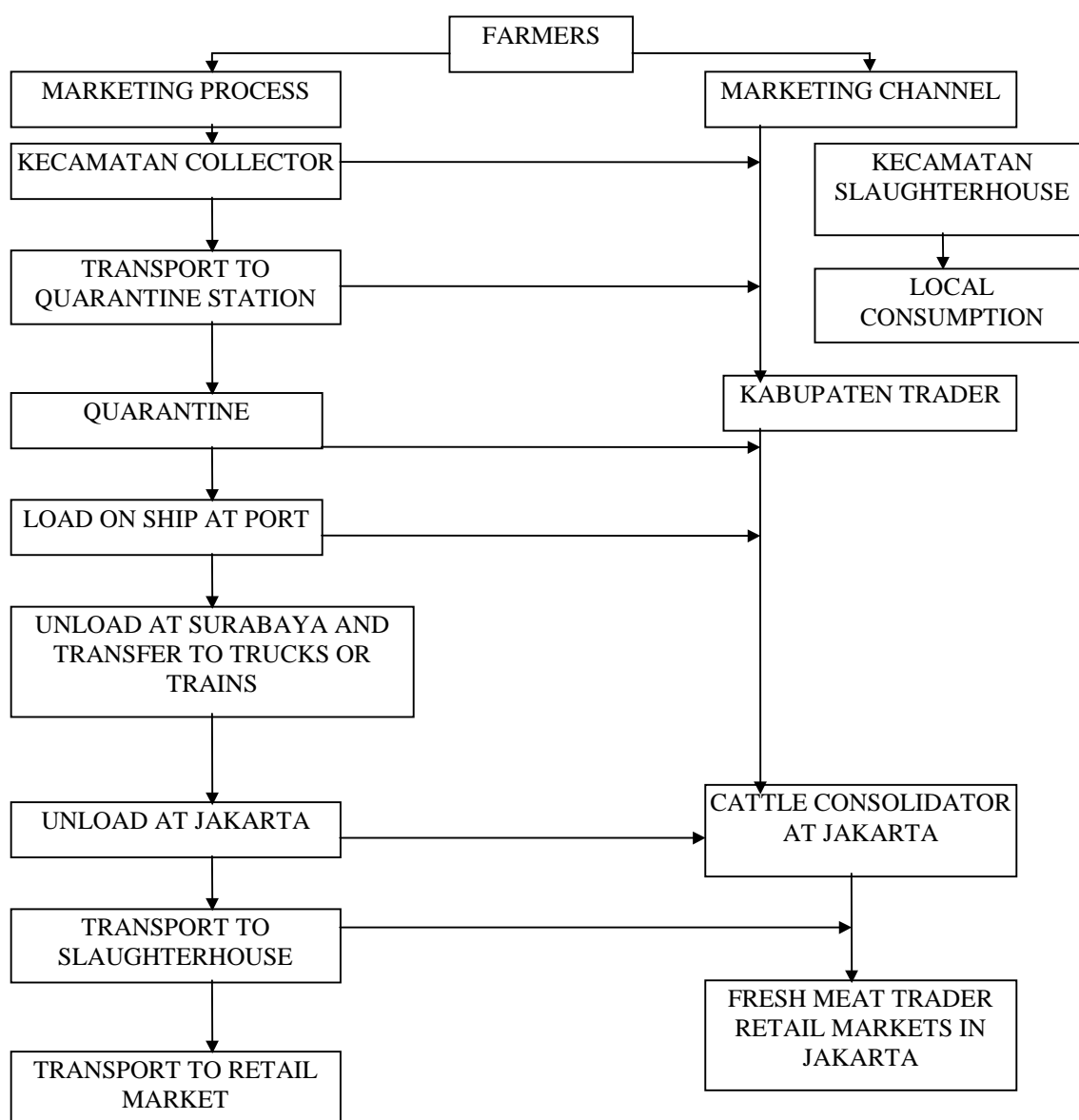
TRANSPORT OF PROCESSED PRODUCTS TO RETAILERS AND CONSUMERS

Meat from the slaughterhouse is transported locally using vehicles that belong to butchers, transport companies or the private sector. There are two types of slaughterhouse: Type B processes meat for inter-provincial distribution, and Type C for inter-district. For inter-provincial meat distribution, the facilities should include chilling or freezing facilities. The transport cost for carcasses varies according to the distance. For example, the cost from Jakarta to Irian Jaya is Rp. 1 850 per kg while from the Cakung to Jakarta it is Rp. 7 500 per carcass. Cakung is 40 km from Jakarta.

OTHER ISSUES

Inter-island movement of live animals supplies beef cattle from areas such as Nusa Tenggara Timur, and Sulawesi to Jakarta. Recently, this movement of cattle has slightly declined due to imports of cattle. The number of cattle and buffaloes shipped from other islands to Java is shown in Table 5.4.

Figure 5.1 Marketing of cattle and buffalo in Nusa Tenggara destined for Jakarta



Source: Madamba, (1997)

Table 5.4. The movement of cattle and buffaloes from other islands to Java, 1991-1997

Livestock	1991	1992	1993	1994	1995	1996	1997
	(000)	(000)	(000)	(000)	(000)	(000)	(000)
Cattle	494	545	554	577	502	619	453
Buffaloes	96	63	77	78	73	60	53
Total	590	608	631	655	575	679	506

Increased income tends to be associated with increased meat consumption especially beef and buffalo beef. The increase in demand and the limited number of cattle and buffalo in Indonesia have increased imports of live cattle and meat (Table 5.5).

Table 5.5. Imports of cattle and meat, 1991-1997

Product	Unit	1991	1992	1993	1994	1995	1996	1997	Average % increase per year
Cattle	head	12 298	22 903	55 999	118 352	246 890	378 316	349 469	82.71
Meat	t	5 532	20 330	8 897	12 708	24 100	15 773	n.a.	34.16

Notes: n.a. = not available

About 40 companies are licensed to import cattle on condition that they work with small farmers in their fattening programme. The arrangements are described in Chapter 2. It appears that this scheme does not work properly. Due to the economic crisis, the price of meat and other animal products increased drastically between January 1998 and the time of writing (mid-1998), and consequently imports of cattle ceased. This led to increased slaughtering of local cattle, and that could eventually reduce the local cattle and buffalo population substantially.

Companies from Australia, Denmark and the Philippines are the main ones involved in importing cattle from Australia and New Zealand. The facilities for handling these animals in Indonesia are very limited, and infrastructure such as disease investigation laboratories and quarantine facilities needs to be improved.

Imports of trucks are permitted based on the Ministerial Decree of Industry and Trade No. 230/MPP/Kep/7/97. There are two types of imported trucks – completely built up (CBU) and completely knock down (CKD) trucks. Both types follow the Indonesian National Standard (Standard Nasional Indonesia, SNI) for vehicle identification number (VIN) and are controlled by the Ministry of Trade and Industry. Imports of truck parts are not restricted, but the importer has to pay a certain amount of import tax.

Increases in fuel prices automatically affect the transport sector, especially its operational costs. In the recent economic crisis, transport costs increased due to the higher prices of imported spare parts.

CONCLUDING COMMENTS

In the future, the transport of livestock, animal feed, and livestock products should be improved and developed. Without good facilities, livestock, animal feed and animal products will not be properly distributed because Indonesia consists of many islands. However, there are several constraints in the development of transportation facilities

Animal feed

- Not all the major islands in Indonesia have harbour facilities suitable for handling imports and for allowing feed and feed ingredients to be transported from one island to another.
- There are many illegal fees that are paid by the transport company. Hence, operating costs will become expensive.
- The schedule of inter-island feed transportation is uncertain, and sometimes the ships have to wait until they are fully loaded. This may reduce feed quality.
- There are no special ships for feedstuffs. Hence, to avoid contamination, the feed is placed in a container. This increases transportation cost.

Livestock

- There are no special ships to carry livestock. Therefore, inter-island transportation of cattle and buffaloes very much depends on other commodities being transported.
- Transport of animals sometimes results in overloading of trucks and this may affect the bruising losses of animals.
- Government officers levy illegal charges at the interprovincial boundary on livestock being trucked from one province to another. This creates problems.

Livestock products

- A very limited number of companies own refrigerated trucks for transporting carcasses or meat. As a result, most traders use ordinary transport facilities to carry meat and this can cause sanitary problems.
- Illegal fees may be charged for inspections at the destination despite the inspection already having been done at the place of origin.

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6. FEED MILLING INDUSTRIES IN INDONESIA

Budi Tangendjaja

Research Institute for Animal Production, P.O. Box 221, Bogor 16002, Indonesia

Animal protein for consumption by Indonesian people comes mainly from beef and buffalo, sheep and goat, pork and poultry. In the 1990-1994 period, the commercial chicken population accounted for 64.2 percent of the total chicken population. The growth of the commercial production of both broilers and layers has achieved impressive results over the most recent five-year planning period. This has resulted in a significant contribution to meat and egg consumption from domestic production.

In line with the rapid growth of the poultry industry, the feed industry has also been growing very quickly. Feed generally is considered to be the major input for poultry production and may account for 65-85 percent of the total production cost. Since poultry feed is composed of several raw materials, the cost and supply of raw materials, either produced locally or imported, affect the feed industry.

This chapter provides information on the feed milling industry, including its structure, government support, and its raw material supply. As well, it discusses constraints to the industry and its future prospects. With data being limited and difficult to collect, the information presented is the best available either from industry or from other sources.

SIZE AND STRUCTURE OF THE FEED MILLING INDUSTRY

Information on the level of production of commercial feed for 1995 to 1997 is presented in Table 6.1. The data for 1997 are subject to revision because of the drastic changes related to the economic crisis since the end of July 1997. Before then, feed production had been increasing at a rate of more than 10 percent per year since 1995. This increase is much the same as the increase in poultry production because most feed is used by the poultry industry.

Table 6.1. Production of commercial feed in Indonesia, 1995-1997

Feed Producer	1995	1996	1997	Capacity	
				1997	Share
	(t)	(t)	(t)	(t)	(%)
Charoen Pokphand	1 496 878	1 608 674	1 553 000	2 670 000	28.10
Japfa Comfeed	1 016 117	1 019 346	1 029 000	1 622 000	17.07
Anwar Sierad	193 232	202 618	287 500	1 200 000	11.58
Wonokoyo	130 000	312 000	192 500	824 000	8.67
Cheil Samsung	–	65 728	150 000	750 000	7.89
Cargill	170 705	183 089	213 350	600 000	6.32
Gold Coin	118 025	154 695	232 600	311 040	3.27
Subur Ripah	–	79 463	72 850	302 400	3.18
Sinta	97 800	185 000	170 000	187 200	1.97
Centra Profeed	81 600	85 600	100 000	180 000	1.89
Others	263 571	680 646	1 051 370	854 000	9.86
Total	3 567 928	4 576 859	5 052 170	9 500 640	100.00

In 1988, Indonesia produced 1 401 176 t of feed; in 1989 production was 1 511 203 t and in 1990, it was 1 880 336 t. In the five-year period 1990-1995, production of feed increased almost 100 percent.

In the two years up to 1998, several new feed mill plants were established and this increased the capacity of the feed industry. Table 6.1 indicates that Indonesia had the capacity to produce 9.5 million tonnes per year of feed in 1997. This production was distributed between 25 feed mill companies. These companies operate more than 25 mills because many have three to six plants located in several places in Indonesia. Production by the feed industry uses around 50 percent of capacity. The industry has a high capacity because feed industries over-anticipated the growth of the poultry industry. Indonesia has a relatively low consumption of poultry meat and eggs compared to other ASEAN countries, and demand is expected to grow as incomes rise. Another possible reason for the excess capacity is the tendency of companies to expand their feed mills to bigger capacities that are possibly more efficient. Companies setting up new feed mills often establish them in a different province. For example, when a company has a feed mill in West Java, it is likely to expand into East Java, or vice versa.

On the basis of the feed mill capacity shown in Table 6.1, feed mills can be divided into three broad groups:

- large feed millers with a production of more than one million tonnes per year; Charoen Pokphand and Japfa Comfeed are in this category;
- medium-size feed mills with a production of more than 100 000 t per year; this group is made up of eight companies, including Anwar Sierad, Cargill and Cintre;
- the small feed mills with a production of less than 100 000 t per year.

All large feed mills are integrated with the poultry industry – each operates a grandparent stock farm, a parent stock farm, a commercial poultry operation, and a poultry processing plant.

Trading companies are also part of some companies. While some medium-size feed mills are not as fully integrated as the large companies, many have parent stock farms for broilers.

Although most protein feed sources for the feed mills are imported, the feed mills do not control the shipping. Many small vessels (with a capacity of 5 000-15 000 t) are able to carry oilseed meal from India, China or Argentina without any major problem. The advantage that large feed mills possess with regard to shipping is that they can import the raw material themselves in large sized vessels such as ‘Panamac’ class vessels. To reduce transport cost, for example, US soybean meal is imported by the two largest feed mills using large ships. The large feed mills gain not only through lower transport cost but also through their strong bargaining power in buying materials, including premix and drugs.

Despite there already being many feed mills in Indonesia and quite intense market competition, the interest of investors in this industry still remains high. The Coordinating Board for Investment (BKPM) reports that in the first nine months of 1997, 15 new investments in the feed milling business were reviewed and given permanent licence for expansion or for a new project. However, the economic crisis, especially in January and February 1998, resulted in a dramatic drop of feed production and some feed mills even stopped production.

The percentage of feed consumed by animal species is shown in Table 6.2. Poultry feed production for both broilers and layers is the major focus of the industry, and represents 85 percent of production. The quantities produced for broilers and layers are about the same. It is expected that the industry will continue to focus mainly on poultry. Aquaculture takes more than 9 percent of the feed produced. Generally shrimp feed is not produced in the plants used to produce poultry feed. Very little feed is produced for ruminant animals. Feed for layers is partly manufactured as a concentrated ration. This is later mixed with corn and rice bran by farmers. In terms of type of feed product, almost all broiler feeds are produced in pellet form, while layer feeds are in mash form. Some starter feed is also provided in pellet form, reflecting a belief in the benefit of pelleting of feed for chickens.

Table 6.2. Percentage of feed produced for different animal types, 1997

Animal type	Feed production	Share
	(t)	(%)
Broiler	2 153 770	42.6
Layer	2 123 650	42.0
Swine	183 540	3.6
Aquaculture	466 950	9.3
Cattle	36 250	0.7
Others	87 510	1.8
Total	5 051 670	100.0

Feed milling plants are concentrated in three major areas, namely the neighbourhoods of Jakarta, Surabaya and Medan. Jakarta is the major area because of its number of consumers of poultry products and its closeness to the port used to import the raw materials. Before the economic crisis, almost one million birds were consumed by Jakarta people every day. The imported raw material arrives in the Jakarta port Tanjung Priok. Many new feed mills have been established in

Serang (to the west of Jakarta) because a new port for handling corn has been built in this area (Cigading). Corn from Lampung also comes through Merak Port which is very close to Serang. Surabaya and Medan have also become major feed industry areas because of port facilities, the large number of consumers of poultry products and their closeness to the local raw material supply, particularly corn and rice bran.

Raw material supply plays an important role in feed mill operation. The prices of raw materials are affected by season. However, very little use is made of contracts in the purchase of corn or rice bran from local sources. Instead, the price follows the current market price. The low price of corn during the harvest season (normally the wet season) has motivated some feed mills to set up corn drier facilities with silos, to cope with the price increase during the off season. The other important ingredient, rice bran, is difficult to store because it is not stable when stored for long periods.

A typical poultry feed formula is presented in Table 6.3. As reported earlier, the major imported raw materials are protein sources. Almost 30 percent of feed raw materials are imported, namely soybean meal, groundnut meal, rapeseed meal, meat bone meal, corn gluten meal, fishmeal, etc. Procurement is done at the world market price.

Table 6.3. Typical poultry feed formula used by feed mills

Ingredient	Broiler share	Layer share	Average share
	(%)	(%)	(%)
Corn	50-60	40-50	50
Soybean meal	15-25	10-20	18
Rice bran	0-10	10-30	15
Wheat pollard	–	0-10	5
Animal by product meal	0-5	0-5	3
Rapeseed meal	0-5	0-3	3
Fat/oil	0-3	–	1
Others/oil seed meal	5	5	5

GOVERNMENT REGULATIONS

During the five-year period to mid-1998, the Indonesian feed industry grew by about 12 percent annually. As noted earlier, this is mostly because of the increase in poultry production. Therefore, any change in government policy for the poultry industry will also affect the feed industry. With regard to investment policy, Presidential Decree No. 23/1991 put a restriction on investment in the feed industry. The industry is still open to new investments both by local (PMDN) and by foreign investors (PMA). However, there are some requirements for foreign investors set out by the Coordinating Board for Investment (BKPM). One such requirement is that foreign investors must be in a joint venture with Indonesians. The Indonesian share has to be at least 20 percent at the initiation of the project, rising to 51 percent after 15 years. A venture with foreign investment, located in a border zone (such as Batam Island), and exporting 100

percent of its production is only required to share 5 percent with the Indonesian partner. However, a foreign investment that exports at least 65 percent of its production and which is not in the border zone is required to set aside 20 percent of its share to Indonesian partners within 10 years and 51 percent after 15 years of commercial operation. It is also required that foreign investment must exceed US\$1 000 000 except in those enterprises that can meet the following conditions:

- labour intensive with at least 50 workers;
- at least 65 percent of production is for export and the project is located in the eastern islands of Indonesia. These include West Nusa Tenggara, East Nusa Tenggara, East Timor, South Sulawesi, Southeast Sulawesi, Central Sulawesi, North Kalimantan, Central Kalimantan, Bengkulu and Jambi. PMAs of this type may start with an investment of at least US\$250 000. Co-operatives or small enterprises are given priority to become the Indonesian partners

The local feed mills are not required to sell or export their products. They can sell the output locally if they follow the quality and safety regulations. Unlike dairy farmers who obtain feed from the co-operatives, feed mills are not required to sell their products to co-operatives. The feed mills are permitted to appoint a number of distributors or retailer agents in an area so long as the following rules are satisfied:

- the appointment must be in writing with a copy sent to the Directorate General for Livestock Services (DGLS);
- the distributor or agent must have a trading licence from the Minister of Industries and Trade;
- feed mills remain responsible for feed quality and distributors or agents are prohibited from replacing the original packaging of the feed;
- animal feed cannot be sold in the same area as chickens or eggs;
- distributors or agents must comply with, and commit themselves to, the regulations for the control of animal feed.

Earlier it was stated the cost of feed is very much affected by the cost of raw material. The National Logistic Organization (BULOG) at one time procured feed ingredients. However, in 1989, BULOG waived its monopoly right in the procurement of corn, fishmeal and soybean meal. In May 1995, the government issued a new deregulation policy to improve business efficiency, to strengthen economic resilience and to increase competitiveness. The import duty and surcharge on animal feed were reduced; for some feeds they were abolished. Import duties of feed ingredients were reduced to a range of 0-5 percent. The major ingredients for poultry feed, such as corn, soybean meal, fishmeal, groundnut meal and bone meal, have zero import duty.

Most poultry feeds are processed with modern equipment that has been imported. Equipment suppliers may come from Europe, the USA or Taiwan. Several of the newly set up feed mills were built as turn key projects, while other feed mills are only partly supplied with machinery. There is no preferential treatment given to this industry. Investors can apply to the Coordinating Board for Investment (BKPM) with a master list of the equipment to be imported. They are exempt from import duties as long as they comply with the conditions set out by the government. As already stated, major feed mills are located close to the production farms and the breeding farms. There are incentives to build feed mills in certain areas, like the incentives given to foreign investment, but very few feed mills have been built recently in the eastern parts of Indonesia. All new feed mill projects owned by foreign companies are located in Java except for one in West Kalimantan.

Deregulation has been enforced in Indonesia and there is a great interest from industries to accept it. It is expected that better efficiency that improves the business climate may accelerate the growth of the feed industry. Since most of the industry is set up to meet local demand, there is very little opportunity to export poultry feed. Thus, although Indonesia has accepted the GATT agreement, it is generally thought that it would not have major implications for the feed industry. The only possible impact would be if poultry farm numbers decreased and the local production of poultry were to be replaced by imports of poultry products. If the cost of production of poultry meat in the USA or Brazil is much less than in Indonesia, it is possible that imports of poultry meat will become competitive and feed production will be affected. However, considering the local production of corn, the relatively low price of rice bran and the consumer preference for hot carcasses of chicken, the effect of GATT on Indonesia is likely to be minor.

INGREDIENTS

Since almost 90 percent of feed produced by the feed mill industry is for poultry, the typical feed ingredients used are those required by poultry farms. There are two distinct formulas for broilers and layers. As shown in Table 6.3, on average corn and soybean meal constitute almost 70 percent of the total ration. Although the DGLS has given a typical formula for poultry feed, it has never been followed by feed mills due to the rapid development of nutrition and feed availability.

Feed mills sometimes use unconventional feedstuffs. These include cassava chip, palm kernel meal or coconut meal. However, those ingredients are not commonly fed to chickens due to their price and low nutritive value. A large proportion are exported or used locally as ruminant feed.

While corn is one of the main ingredients for poultry feed, its use is not restricted to feed. Corn is put to the following uses: 61.5 percent is for human food, 29.5 percent is for feed, 5 percent is for seed, 3.5 percent is exported and 0.5 percent is lost (CIC, 1996). Corn is used in poultry rations as a source of energy. Although corn is not the only grain used for this purpose, other grains such as sorghum are in limited supply and available only in certain parts of Java during the dry season. With regard to corn production (Table 6.4) before 1990, Indonesia was self-sufficient. However, as already noted, during the last ten years the demand for corn for feeding poultry increased significantly as the poultry industry grew. This resulted in corn being imported to meet local demand. In 1990, the volume of corn required by the feed industries reached 1.3 million tonnes and in 1996 it was estimated to reach 3.5 million tonnes. In 1998, it was estimated that 4.1 million tonnes of corn was needed for the feed industry. In the beginning of 1990, corn was imported from China and Thailand. However, in recent years corn has been imported predominantly from the USA because of insufficient supply from China. The rate of increase up to 1994 was more than 12 percent and at that time the trend in imports was expected to continue into the future. Before 1988, the National Logistic Organization (BULOG) was the only agency authorized to procure corn or other basic ingredients such as soybean meal and fishmeal. At present the private sector is allowed to import corn. The corn used for poultry is yellow corn and only small quantities of white corn are available. Although nutritionally white and yellow corn are not different, white corn is sold at a slightly lower price.

Table 6.4. Production and imports of corn and rice bran, 1990-1997

Year	Corn				Rice bran	
	Production	Growth	Import	Growth	Production	Growth
	(kt)	(%)	(kt)	(%)	(kt)	(%)
1990	6 734	–	9	–	3 163	–
1991	6 256	–7.1	323	3472	3 128	–1.1
1992	7 996	27.8	56	–83	3 377	7.9
1993	6 460	–19.2	495	785	3 373	–0.1
1994	6 869	6.3	1 118	126	3 265	–3.2
1995	8 223	19.7	969	–13.4	–	–
1996	7 954	–3.3	617	–36.4	–	–
1997	9 261	16.4	478	–22.5	–	–

Most of the corn imported is US Grade No. 2, and this is normally used for animal feed. With regard to quality, considerations in the purchase of corn are moisture content and the proportion of broken or damaged kernels and contamination by foreign material. The presence of mycotoxin has been put forward as an additional criterion. Although the moisture content of corn has been limited to a maximum of 16-17 percent, many feed mills are still willing to receive corn with a high moisture content if there is a price adjustment. Many feed mills are equipped with either an on-site corn drier or a special buyer that dries corn in the production area. Corn drier facilities can be very necessary because much of the corn is harvested in the rainy season. Poor methods of handling corn can result in increased incidence of mycotoxin contamination. Results of a survey by a research institute showed that almost all corn produced locally was contaminated by aflatoxin to varying degrees.

The Indonesian Government has stated that the country will have to reach self-sufficiency in corn and also that it has to try to reduce corn imports. There are several options for increasing corn production. The first two are to increase the corn-growing area or to switch to hybrid corn. Increasing the area planted is perhaps more difficult due to competition with rice production. The alternative, hybrid corn, is more realistic but the adoption rate has been slow. In the last two to three years, the government has launched a hybrid corn programme with a target of 500 000 ha of corn. The programme covers Java, Lampung, South Sulawesi and North Sumatra. Currently, there are three hybrid corn producers in Indonesia – the Charoen Pokphand group, Cargill and Pioneer.

Table 6.5. Imports of soybean meal and soybean, 1990-1997

Year	Soybean meal		Soybean	
	(kt)	(% change)	(kt)	(% change)
1990-1991	5.2	–	526	–
1991-1992	193	3581	631	19.9
1992-1993	171	–11.7	688	8.9
1993-1994	361	111.6	700	1.8
1994-1995	499	38.1	628	–10.3
1995-1996	894	79.3	–	–
1996-1997	1 085	21.4	–	–

The second major ingredient for poultry feed is soybean meal. This material is all imported, coming from India, Argentina, Brazil, China and USA. Indonesia grows more than 1.5 million tonnes of soybean per year, but this production is not sufficient to meet the demand for processed products such as tempeh, tofu and soya sauce. In 1990, Indonesia established a soybean crushing plant located in Jakarta but it was closed down in 1996.

Imports of soybean meal increased steadily in the first part of the 1990s, resulting in more than 1 million tonnes being imported in 1996-1997. Between 1990 and 1994, imports increased at a rate of 9.4 percent per year, almost the same rate of increase as was recorded for the poultry industry. There was a dramatic increase of more than 100 percent from 1994 to 1997. The main supplier was India, followed by South America. The USA supplied 56 000 t in 1996-1997 but none in 1997-1998. In contrast with whole soybeans, imports of US soybean meal are limited because of its higher price and the fact that it cannot be shipped in small quantities. Only large feed mills can import soybean meal from USA using “Panamac” class vessels. Before 1996, with the local crusher still operating, the government applied a tariff on imported soybean meal and set a local content requirement. The tariff was lifted but the government then added a 10 percent tax. Now, the tax has also been lifted and feed mills can import directly for their own use without paying a tax.

Soybean meal is regarded as the best protein source for poultry. If properly processed, its digestibility for chickens is relatively high compared to other plant protein sources. Most feed mills have used soybean meal in their formulae, although other oilseed meal sources are available, such as groundnut meal from India. Rapeseed meal imported from India or China is also used in small quantities – the maximum is 3 percent – due to possible toxicity and low digestibility.

The quality of soybean meal coming to Indonesia varies not only in its protein content but also in other quality parameters such as KOH-solubility and urease activity which indicate the adequacy of processing. Indian soybean meal contains hulls that increase the fibre content in the feed.

Besides corn and soybean meal, rice bran is a major ingredient of poultry rations. Rice bran may account for up to 10 percent of the ingredients of broiler feed, while for layer feed this percentage can be up to 30 percent. Rice bran is produced by many small rice mills throughout Indonesia especially in the rice producing areas. It is estimated that more than 3.5 million tonnes of rice bran is produced per year. Rice bran is viewed as a relatively cheap feed ingredient for

poultry within ASEAN countries, but it cannot be stored for long periods because of its instability during storage. Hydrolytic rancidity of the oil in rice bran and insect contamination are the main problems. The quality of rice bran varies depending on the amount of contamination by rice hulls. Observations in the field have indicated that hull inclusion may vary from close to 0 to up to 50 percent in rice bran. Since rice hull has no nutritive value as poultry feed, feed mills need to check the amount of hull before accepting the bran for poultry feed. Other contaminants that have also been detected in the field include cassava waste, soil, limestone and sawdust. The price of rice bran fluctuates more than any other local ingredient, varying by up to or over 100 percent depending on the season.

Indonesia also produces wheat pollard/bran as a by-product of wheat milling. Estimates are that 30 percent of imported wheat (2.5 million tonnes) is produced as a by-product. The quality of wheat pollard/bran is more consistent than rice bran because it is produced by a few large wheat mills. The use of wheat pollard in poultry feed is limited, and most wheat pollard is sent to dairy co-operatives for dairy cows.

Cassava chips or pellets are available in certain parts of Indonesia. Once cassava pellets were exported to Europe under a quota system. Recently, the quota system has been closed and cassava chips have become available for use as a poultry feed. If they are used in broiler rations, an addition of oil is sometimes needed. The types of oil available in Indonesia are crude palm oil and fish oil, the latter being seasonal and produced from sardine-type fish.

To provide a balanced diet for poultry, several minor ingredients and feed additives are needed. Dicalcium phosphate is mostly used as phosphate source. This material is imported from Belgium, USA or China. Local phosphate sources are limited, with bone meal sometimes being used. Most calcium comes from locally available limestone or oyster shells. The situation is similar for salt. All other feed additives including vitamins, trace elements, coccidiostat, growth promotants, choline chloride, antioxidants, preservative or nutritional supplements such as enzyme, are imported.

The choice of the ingredients used in formulating the feed ration is influenced by price, availability and services provided by the supplier. Most feed mills use computer programmes to formulate the diet, with linear programming being used for single mix or multimix mixtures. In linear programming, the nutritive value and price are the constraints that need to be considered. The prices of imported ingredients depend upon developments in the world market, while local ingredient prices are affected by the season. Traders, both international and local, are well informed regarding world market prices and the information is available to the feed mills. Some feed mills may import certain ingredients directly without using outside traders. They open up a letter of credit, at sight or later, depending upon the relationship between purchaser and supplier. Some feed mills, particularly the smaller ones, obtain ingredients through local traders using local currency. The price is normally the landed cost of ingredients plus value-added tax, income tax or import duty, and a margin for the trader.

On average about 82-85 percent of the selling price is the cost of raw materials, and to this is added the cost of processing, any losses, the cost of packaging and so on. During the economic crisis of 1997, the feed mill association increased the selling price of feed several times to take account of the fluctuation in the exchange rate between the Indonesian rupiah and the US dollar. Most of the feed mills lost money during this period.

The change in the price of feed for both layers and broilers through the years is shown in Table 6.6. As this table shows, prices have risen steadily over the last few years due to the increasing prices of local ingredients and the depreciation of the rupiah relative to the dollar.

Table 6.6. Average price of feed in Indonesia

Year	Layer		Broiler
	Starter	Layer	
	(Rp./kg)	(Rp./kg)	(Rp./kg)
1990	573	492	589
1991	602	541	623
1992	606	520	660
1993	600	540	707
1994	694	624	688
1995	716	641	794
1996	798	760	913

FUTURE PROSPECTS AND PROBLEMS FOR THE FEED MILLING INDUSTRY

Between 1990 and 1994, broiler consumption rose 15.5 percent and this accounted for 56 percent of chicken meat consumption. Besides broilers, people also consume village chickens (*kampung* chickens) which are normally raised in backyard systems. The *kampung* chicken is multi-purpose, being used for meat or for egg production. Although its contribution to protein has become smaller in percentage terms and although it has poor efficiency in converting feed to protein, the village chicken is raised extensively because of its low input costs. Chapter 1 describes the village chicken production system.

Based on income and population, Capricorn Indonesia Consult, Inc. (CIC, 1996) predicted that chicken meat and egg consumption would increase steadily over the next few years (Table 6.7). Based on this prediction, it is possible to make forecasts of feed requirements. This is because 85-90 percent of the feed is produced for broiler and commercial egg production. With almost equal production of feed needed for broilers and layers, feed requirements will increase at a rate of 8.3 percent per year. The prospects for the feed industry remain good and the opportunity for investment will continue to expand. Many firms in the feed industry continue to expand their scale of production and also the extent to which their operations are vertically integrated. New feed mills in West Java have already been built by local investors such as PT Wonokoyo or PT Kerta Mulya, and by foreign companies such as PT Cheil Jedang from Korea and PT Cargill from USA. The expansion has occurred in the Jakarta area, in Surabaya (PT Anwar Sierad and PT Arta Citra Terpadu), and in Lampung (PT Anwar Sierad and PT Centra Profeed).

Table 6.7. Estimate of total consumption of chicken meat and eggs in Indonesia, 1995-2000

Year	Broilers	Village chickens	Commercial eggs	Village chicken eggs
	(t)	(t)	(t)	(t)
1995	548 746	261 679	376 896	97 642
1996	606 929	275 697	398 669	99 171
1997	672 644	287 988	420 906	102 709
1998	744 101	298 458	447 687	104 256
1999	823 537	311 160	475 038	107 869
2000	909 095	321 971	505 053	111 532
Average growth (%)	10.62	4.29	6.01	2.69

Vertical integration has been started by firms with their own broiler farms and processing plants. At least two slaughterhouses for broilers have been completed recently. They are owned by PT Charoen Pokphand and PT Wonokoyo. It seems that a few large feed mills and their integrated companies are likely to dominate the industry. The small feed mills with production less than 50 000 tonnes per year will disappear unless they use feed from their own farms.

The economic crisis in Indonesia has resulted in a severe setback to the poultry industry and the feed mill industry. The US dollar exchange rate rose from Rp. 2 400 in July 1997 to Rp. 9 000 in February 1998. This caused an increase in the prices of imported products such as soybean meal, meat bone meal, rapeseed meal, synthetic amino acids (lysine, methionine), vitamins, minerals and drugs. However, the final prices of feed were not three times higher and did not follow the US dollar exchange rate because of the relatively low prices of corn and rice bran. The increase in feed prices forced farmers to increase the prices of eggs and broilers. The egg price rose from Rp. 2 000 per kg to Rp. 4 500 per kg at the end of February 1998. With the economic crisis, the populations of poultry, both broilers and layers, have fallen drastically. Many people have claimed that the total broiler population decreased from 15 million birds to only 5 million birds while the layer population decreased to less than 40 percent of its pre-crisis level. Since most feed is produced for poultry, the feed producing industry has been badly affected. It is difficult to get accurate data but production in 1998 was at most only 40 percent of production in 1997 (5 million tonnes). Several feed mills have closed down while the surviving feed mills have reduced their production. As well, several feed mills that were recently built in West Jakarta have not yet begun to operate. Also, new contracts to build feed mills have been cancelled.

It is not possible to predict when the situation will recover. Poultry farms are operating at 40 percent capacity, and broiler and egg demand has declined due to the lower purchasing power of the average household. Production from feed mills will not recover for one or two years because of the situation in the poultry industry.

CONCLUDING COMMENTS

The following points can be made on the basis of the information in this chapter.

- The feed industry grew at the rate of more than 12 percent per year in the first part of 1990. Production was dominated by commercial chicken feed for broilers and layers. This accounted for 85 percent of the total feed production. The industry remains dominated by large and medium-size feed mills. Large mills have a capacity of more than 1 million tonnes per year while medium mills have a capacity of more than 200 000 tonnes per year.
- About 30 percent of the raw materials for poultry feed are imported and most imports are either plant protein or animal protein. If the promotion of hybrid corn leads to its being accepted by farmers, Indonesia could become self-sufficient in corn. However, Indonesia is still importing corn to meet the demands of the feed industry. The price of feed will increase in years to come due to the depreciation of the rupiah, and this will inflate the price of imported raw materials.
- The government provides an environment conducive for investment in the feed industry, and new investors, local and foreign, are still interested. Although a co-operative system is encouraged, there is no obligation to sell products to the co-operatives.
- While the future prospects of the feed milling industry are uncertain and new plants have recently been established, the economic crisis has resulted in a dramatic drawback of the industry. If production drops to between 30 and 40 percent of the pre crisis level, the future of the feed milling industry becomes questionable.

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7. PROCESSING AND MARKETING OF LIVESTOCK PRODUCTS IN INDONESIA

Atien Priyanti

Central Research Institute for Animal Sciences, Jl. Raya Pajajaran, Bogor 16151, Indonesia

and

I.G. Putu

Research Institute for Animal Production, P.O. Box 221, Bogor 16002, Indonesia

The livestock sector is an important segment within the economy of Indonesia, providing almost all the meat and eggs and part of the milk required for domestic consumption. The government of Indonesia is keenly aware of the importance of the livestock sector as a supplier of animal protein for human consumption, raw materials for industry, and manure as fertilizer for agriculture. In addition, the livestock industry has the potential to generate employment, increase rural incomes and improve the productive use of land.

Rising per capita incomes and changes in population structure have led to changes in food consumption patterns that place increasing demands on the development of the food processing and livestock industries. During 1996, per person consumption of meat, eggs and milk increased by 6.7 percent, 5.8 percent and 3.8 percent, respectively. Improvements in levels of nutrition suggest that the consumption of animal protein may reach the standard 6.0 g per person per day. In 1996, for example, it was 5.8 percent higher than in 1995. Continued growth in the livestock industry, as well as in the general agricultural sector, helps absorb Indonesia's increasing labour force and plays a part in the country's transition to an industrialized economy.

This chapter provides information on the processing and marketing of livestock products in Indonesia, including the development of slaughterhouses and the processing and handling of meat. The discussion of marketing will focus on the marketing patterns and the structure of marketing from the farm level to the final product.

PROCESSING

Slaughterhouses

There are four classes of slaughterhouse in Indonesia based on the role the slaughterhouse plays in meat distribution:

- Enterprise A slaughterhouses supply meat for export;
- Enterprise B slaughterhouses supply meat for residents in the provinces;
- Enterprise C slaughterhouses supply meat for residents in regencies within the provinces; and
- Enterprise D slaughterhouses supply meat for residents within the regency.

Under Indonesian law these four types of slaughterhouse can be managed by any person with Indonesian citizenship or by a corporate body. Operators of slaughterhouses have to hold a permit depending on the slaughterhouse class. For slaughterhouses A and B, the permit is issued by the Directorate General for Livestock Services (DGLS); operators of C class slaughterhouses require a permit issued by the Provincial Governor; and those operating D class slaughterhouses need to hold a permit issued by the local government of the regency. Note that if the slaughterhouse was developed under the investment programme based on Ordinance No. 1, 1967, of the foreign investment programme or Ordinance No. 6, 1968, of the local investment programme, the Head of the Department of Coordination for Investment (BKPM) had to give permission according to the Decree of the President of the Republic of Indonesia No. 33, 1981, and the Decree of the President of the Republic of Indonesia No. 54, 1977.

To set up a processing facility, certain procedures have to be followed. These include the submission of a feasibility study together with details of the sources of raw materials, a marketing plan, and technical aspects of the project. Acceptance by the local community is also a part of this process. The Department of Animal Husbandry has to certify that the location of the slaughterhouse will not create environmental pollution. This means that they are usually located outside centres with low population density, near to a river; or at the lowest altitude of the urban centre. The availability of transportation facilities is also important.

The meat processing industry in Indonesia encompasses more than 900 slaughterhouses (Table 7.1), divided into three categories based on species slaughtered. Thus there are slaughterhouses for large ruminants, for pigs and for poultry. They are classified into three types by the daily slaughter capacity:

- type A for more than 100 head slaughtered per day;
- type B for 50-100 head slaughtered per day; and
- types C or D for 5-50 head slaughtered per day.

Based on the facilities available in them, there are three types of slaughterhouses: public slaughterhouses; modern slaughterhouses with mechanized line dressing facilities; and private slaughterhouses. Public slaughterhouses are operated by the local government under the supervision of the provincial meat inspector and under the control of the DGLS of the Ministry of Agriculture.

Table 7.1. Number of slaughterhouses by province in Indonesia

Province	Ruminant slaughterhouse			Pig slaughterhouse			Poultry slaughterhouse			Total
	A	B	C/D	A	B	C/D	A	B	C/D	
Aceh	-	-	21	-	-	1	-	-	-	22
North Sumatra	-	1	37	-	1	45	1	-	-	85
West Sumatra	-	-	10	-	-	-	-	-	-	10
Riau	-	-	4	-	-	8	-	-	-	11
Jambi	-	1	2	-	-	1	-	-	-	4
Bengkulu	-	-	2	-	-	-	-	-	-	2
South Sumatra	-	-	13	-	-	13	-	-	-	26
Lampung	-	-	2	-	-	1	-	-	-	3
Jakarta	1	-	2	1	-	-	1	-	-	5
West Java	1	1	157	-	1	14	4	3	-	181
Central Java	2	2	79	-	1	24	-	-	-	108
Yogya	-	1	18	-	-	3	-	-	-	21
East Java	1	1	229	-	-	31	-	-	-	262
West Kalimantan	-	-	23	-	-	15	-	-	-	38
Central Kalimantan	-	-	34	-	-	6	-	-	-	40
South Kalimantan	-	-	9	-	-	15	-	-	-	24
East Kalimantan	-	-	7	-	-	14	-	-	-	20
North Sulawesi	-	-	4	-	-	4	-	-	-	8
Central Sulawesi	-	-	7	-	-	1	-	-	-	8
South Sulawesi	-	1	42	-	-	6	-	-	-	49
South-east Sulawesi	-	-	3	-	-	1	-	-	-	4
Bali	-	1	2	-	-	1	-	-	-	5
West Nusa Tenggara	-	3	6	-	-	-	-	-	-	9
East Nusa Tenggara	-	1	2	-	-	-	-	-	-	3
Maluku	-	-	2	-	-	-	-	-	-	2
Irian Jaya	1	-	5	-	-	-	-	-	-	6
East Timor	-	-	1	-	-	-	-	-	-	1
Total	6	13	721	1	4	203	5	4	0	958

Notes : Type A >100 head/day
Type B 50-100 head/day
Type C/D 5-10 head/day

Source: DGLS (1996)

Of those slaughterhouses managed by the local government, some are not up to standard because they have been operating for more than 50 years. A major improvement programme is needed to rebuild them based on current requirements. For this to happen, foreign and private investors are needed to stimulate the activities of the meat business. Almost 87 percent of meat production in 1997 (876 000 t of this was poultry), came from traditionally managed private slaughterhouses. Poultry slaughterhouses only provided a small proportion – around 12 percent. The poultry slaughterhouses need to improve their technical specifications, including the development of accreditation and certification procedures to guarantee the quality of livestock products. There is also the need to develop Hazard Analysis Critical Control Point (HACCP) and labelling. Most slaughterhouses outside Jakarta operate under this system. The number of animals slaughtered at public facilities varies depending on

the demand from adjacent larger towns and cities for fresh meat. Table 7.2 shows the number of recorded slaughters of animals in Indonesia from 1990 to 1995.

Table 7.2. The number of recorded slaughters of animals in Indonesia, 1990-1995

Year	Cattle (head)	Buffalo (head)	Goat (head)	Sheep (head)	Pig (head)
1990	1 262 781	201 305	1 165 167	507 482	1 125 565
1991	1 277 323	216 064	1 140 315	598 485	1 000 427
1992	1 446 901	204 550	1 375 188	483 425	1 362 731
1993	1 686 896	232 880	1 423 713	640 803	1 539 289
1994	1 551 375	211 282	1 628 811	721 548	1 475 939
1995	1 601 370	219 988	1 714 501	793 874	1 613,924

Source: DGLS (1996)

There are six modern slaughterhouses with mechanized line dressing facilities in Indonesia. These are in Jakarta and in various parts of Central Java. These relatively new facilities were built to cope with the rapidly increasing demand for meat in Jakarta. Environmental considerations, primarily concerning waste disposal, also stimulated their construction. Under normal conditions, a slaughterhouse in Jakarta would handle 500-750 head of cattle and buffalo per day. During the holy days or Idul Fitri, as many as 2 000-2 500 cattle and buffalo are slaughtered each day. The slaughterhouse charge varies between Rp. 15 000 and Rp. 25 000 per head, including the overnight chilling of carcasses and refrigerated transport of carcasses to the markets. After resting the animals for one night in pens, slaughtering starts at 1.00 p.m. After bleeding, the carcasses are hoisted and moved along an overhead rail system where dressing takes place on a line. Carcasses are generally chilled overnight and delivered to the meat market early the next day.

PT Ciomas Adisatwa, a modern poultry slaughterhouse in Jakarta, has a commitment to produce not only high quality products needed by consumers but also *halal* certified food. Slaughtering of domesticated animals has to be carried out by Moslem officials according to the approved method issued by the Indonesian Islamic Council (MUI) to meet the demand of the moslem majority. The *halal* meat has two criteria:

- *halal* at slaughter; and
- *halal* at processing.

To achieve the *halal* process, the birds should be in healthy condition and in a clean environment. The butchers are trained to slaughter the animals *halal*. Hence, they have an important moral responsibility. The slaughter must be done quickly using a very sharp knife by cutting the three gutters: the respiratory tract, the oesophagus, the vena and artery blood vessels. In addition the butcher has to say “*basmallah*” before starting to cut the birds. The process should be done properly to avoid stressing the poultry. Otherwise, the quality of the carcass will not meet the standard.

Since 1990, PT Ciomas Adisatwa has been able to supply McDonald’s Family Restaurants. Moreover, in 1993 PT Ciomas Adisatwa became a prime supplier of McDonald’s for the whole of Indonesia. McDonald’s International has given an HACCP certificate to verify food safety standards. With the increasing number of McDonald’s outlets in Indonesia – there were 75 in 1997 – PT Ciomas Adisatwa has developed very quickly. They had plans to build two new processing plants in Lampung and Surabaya by the end of 1997.

Most private slaughterhouses operate on a small scale and mainly process goats, sheep and some pigs. Slaughtering generally takes place in the early hours of the morning. Warm carcasses or hot deboned meat, bones and offal are transported to the meat markets for sale on the same day. Although regulations often require meat to be hanged for at least eight to ten hours before distribution to the markets, a lack of facilities precludes hanging in many cases. Most consumers are unaware of the benefits of hanging, and are more concerned with obtaining fresh meat.

Fees for the use of public slaughterhouse facilities and services are set by the local government and these vary substantially. The services include livestock inspection managed by specialists from the DGLS. Table 7.3 shows inspection fees in a public slaughterhouse in Bogor in mid 1997.

Table 7.3. Slaughtering and transportation fees at Bogor slaughterhouse, June 1997

Species	Slaughter and inspection fees (Rp./head)	Transportation fees (Rp./head)
Cattle/buffalo	24 000	2 400
Sheep/goat	4 000	400
Pig	12 000	1 200

Source: Field survey

The supervision of the slaughterhouses to meet international standards of hygiene is carried out by the Local Department for Livestock Services (Dinas Peternakan) under the control of the DGLS. The local inspection staff are associated with the DGLS, but they are under the administrative control and are paid by local authorities. Consequently, the livestock specialists at slaughterhouses are not very keen to implement and enforce standards, especially where expenditure by local authorities is necessary to resolve problems.

Meat processing

Slaughtering of domesticated animals and handling procedures for meat and offal are regulated under the Decree of Minister for Agriculture No. 413/Kpts/TN.310/1992. Before the animals are slaughtered, the inspecting officer has to carry out an *antemortem* inspection of the animals standing and moving from all directions, and check the mouth epithelium, eyes and nose, skin, sub-maxillaries, lymph node, paratidea, pre scapularis and inguinal, any sign of hormonal treatment and body temperature. At the end of the inspection the animals are classified into one of the following categories:

- the animal may be slaughtered without further requirements;
- the animal may be slaughtered if certain requirements are met;
- the animal is not allowed to be slaughtered and the slaughter process is delayed; or
- the animal is not allowed to be slaughtered at all.

Post-mortem inspection is carried out by the inspector as soon after completion of slaughter as possible. This takes place in a special room or other approved place with sufficient lighting. The post-mortem inspection involves a simple procedure such as a smell test and a visual test of meat colour. The purpose of post-mortem inspection is to guarantee the hygiene and suitability of the product for human consumption. At the end of the inspection, the meat is classified as (i) meat able to be distributed for human consumption, (ii) meat suitable for

human consumption provided certain requirements are met before distribution, (iii) meat that may be distributed for human consumption provided certain requirements are met during distribution; or (iv) meat that is not permitted to be distributed and that is not recommended for human consumption.

Meat should be subject to approved handling methods. These include at least eight hours hanging on a deboning rail in a chiller room at low temperature having good air ventilation and clean and hygienic conditions. In addition meat cannot be treated with other materials or chemicals that can change its natural colour.

Over the five-year period up to 1997, the development of a cattle feedlot industry was followed by an increasing number of companies establishing their own meat processing plants. Since then, international standards have been implemented for slaughterhouses, boning rooms storage, and meat cutting standards. The trucking of meat also conforms to international standard. Many of the feedlot operators that are members of the Indonesian Beef Producer and Feedlot Association (APFINDO) have sent staff to learn international standards of meat processing in the USA and Australia. As a result, meat cutting standards have improved significantly. However, to produce standard meat products and to give it a chance to compete with imported beef, an Indonesian National Standard on meat products is required urgently.

Meat processing enterprises in Indonesia are small-scale and follow traditional methods due to a lack of skill and financial support. Common processed meats are meat balls (*bakso*), sun-dried beef (*dendeng*), dry shredded beef (*abon*), sausages (beef, pork or chicken), bacon, ham and beef chips (made from lung, endloins, cartilage, etc.). Processed meats are made in small-scale facilities for local consumption or are prepared in small, semi-mechanized factories.

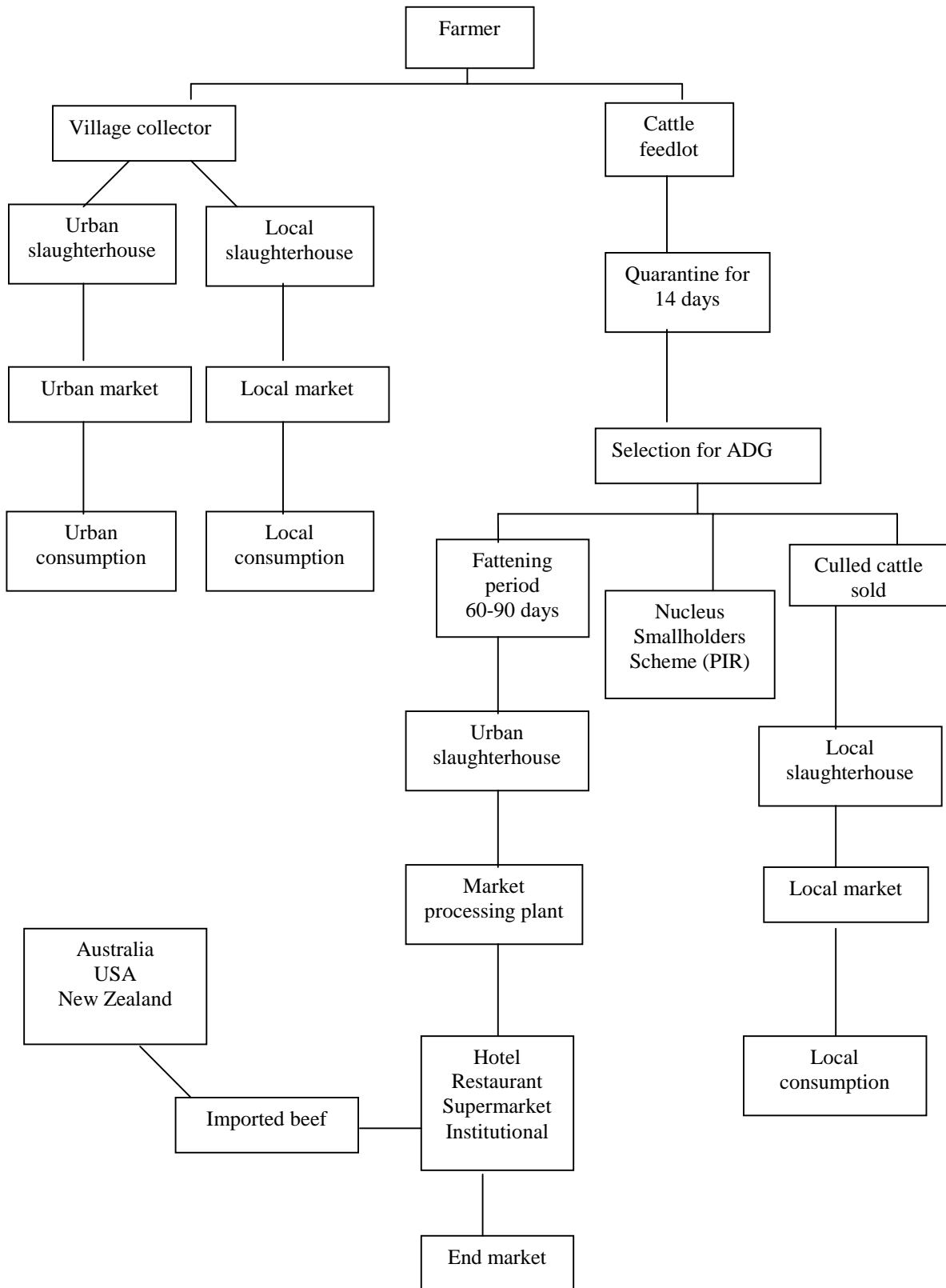
Fresh warm meat is preferred for making *bakso* because of its high binding properties. *Dendeng* is a dried sweetened meat, cured with sugar, salt and spices. *Abon* is fried shredded meat, similar to flaked coconut in consistency, that is sprinkled on top of rice dishes. Some processed meat products have a short life if not refrigerated, and there is no inspection of these products.

The meat industry in general is fragmented and uncoordinated in terms of capacity. Authority and responsibility for regulation is decentralized. Generally, demand is for fresh slaughter-warm meat, and even in large cities people often prefer fresh meat to chilled or frozen meat.

MARKETING

Beef marketing is dominated by wet markets with second and third grade products. Only a small portion of the prime grade beef required especially by hotels and restaurants is produced. Meat used in most hotels and restaurants is imported beef of a certain quality and with a guaranteed level of hygiene. It is higher priced than the local product. Most Indonesian beef is sold at the local market or sent to Jakarta for both the wet and the institutional markets. Imported feeder cattle, after spending 14 days in quarantine, are fattened for 60-90 days on grain. This is done to produce better beef quality. At the end of the fattening period, all finished cattle are slaughtered, processed and stored in Jakarta before being distributed to hotels, restaurants and supermarkets (Figure 7.1).

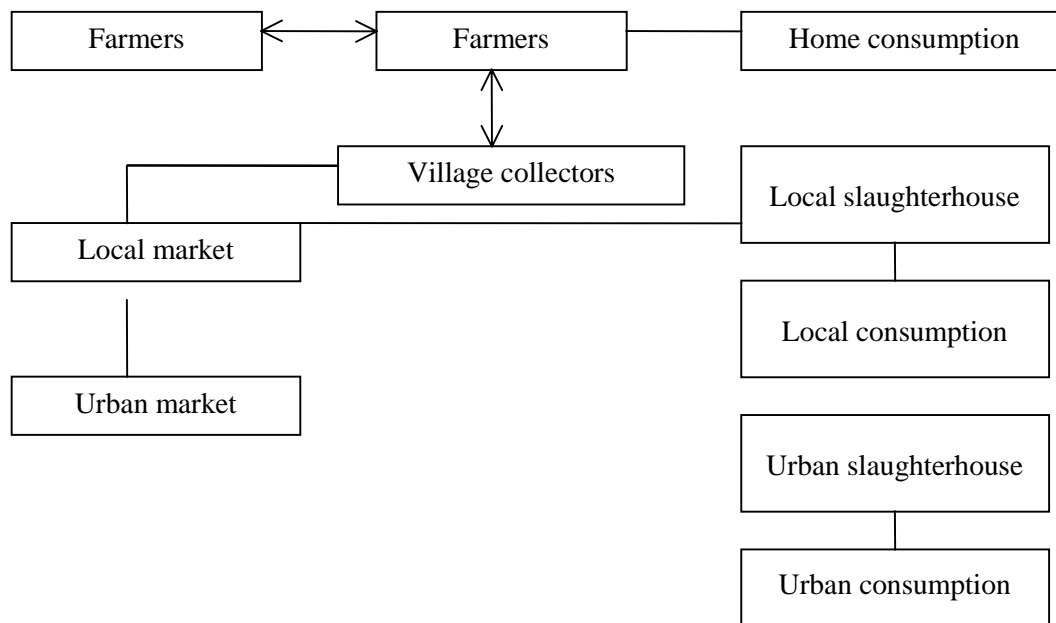
Figure 7.1. Market structure for beef cattle



Increasing demand for beef has occurred at a time when a number of constraints are influencing the development of the cattle feedlot industry in Indonesia. These constraints are as follows:

- an insufficient supply of indigenous feeder steers, particularly in relation to the increase in beef demand and the number of cattle needed for the feedlot industry;
- the bargaining power of buyers, which allows them to select any beef products to improve their competitive position;
- threats of substitution with imported beef, chicken, lamb, goat and pork;
- the bargaining power of suppliers especially for imported feeder steers; in the latter part of the 1990s, the Indonesian feedlot industry is heavily dependent on Australian suppliers and the Indonesian industry also competes with other ASEAN countries to buy feeder cattle; and
- the currency situation of the late 1990s which disadvantages economic development, particularly in the cattle business; this has increased production costs which in turn affect the prices of final products.

Figure 7.2. Market structure for small ruminants



Source: Knipscheer *et al.* (1987)

Figure 7.2 presents a simplified picture of the marketing of small ruminants in West Java. The main market outlets for farmers are the village collectors and the local markets. In isolated areas, farmers generally have access to at least one village collector. In Java, although farmers have easy access to daily or weekly markets, farmers more commonly trade through the local village collector(s).

Farmers rely on village markets for selling animals. Hence, the main determinants of marketing efficiency are the road condition, transport availability and distance from local markets. The location of the local market depends largely on the geographic distribution of animals in a given region. Large ruminants and small ruminants follow almost the same marketing channels. However, small ruminants are easier to transport and have a relatively higher turnover compared to large ruminants.

Most farmers sell animals to village collectors or traders. Only a small proportion of animals are sold directly to final consumers and about 10 percent of the animals sold in local markets are bought by local farmers as replacement stock (Soedjana *et al.*, 1984). The village collector is an important link in the small-ruminant marketing system. For some local traders, this is a part-time activity. In Central Java, the local trader often becomes a respected member of the village society, but that was not found to be the case in North Sumatra.

In Java, a relatively stable relationship seems to exist between trader and farmer, which is characterized as a traditional market system with a cash/credit payment arrangement. A similar system was found in Aceh. In North Sumatra there does not seem to be a credit system between the farmers or producers and traders (Carlson and Scholz, 1991). In addition, a distinction is made between a village collector and a broker. A broker does not have full ownership of the animals, while the village collector does.

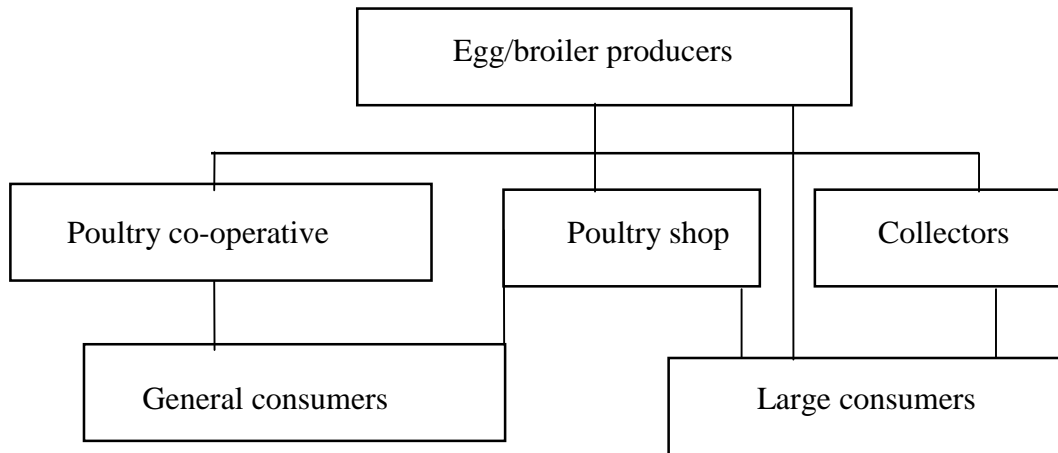
The broker operates in the marketplace, and three types of brokers are common: the commission broker, the floor-price broker, and the price-fixing broker (Soedjana *et al.*, 1992). The commission broker sells animals for a flat fee, the floor-price broker arranges a floor price with the farmer and then tries to sell the animals above that; and the price-fixing broker pays a percentage of an agreed price to the farmer and then tries to sell the animals. When they have been sold the balance is paid.

A market structure that is made up of only a few buyers does not necessarily imply that the market is not efficient because other factors such as volume of sales should also be considered, (Soedjana, 1993). The volume of sales may be insufficient to support other buyers in the market. Also, the large investment in the facilities required for an efficient operation may not justify more than a few buyers. For example, a single buyer with a large facility providing significant economies of scale may operate much more efficiently and at a lower cost than a large group of small, less efficient buyers. Market performance, the most important criterion for judging efficiency, is considered to be particularly unsatisfactory where there is evidence of an excessive or dominant concentration of particular market participants. For example, when there are few buyers, high profits for traders, and possible collusion between buyers, then there are strong indications that the market is not operating efficiently from the producers' perspective.

Poultry marketing

The commercial poultry industry is the fastest growing segment of the livestock sector in Indonesia. It accounts for the major proportion of the eggs and broiler meat consumed by the population, especially in the cities. The market for the intensive poultry business (layers and broilers) is well organized. Large poultry farmers may develop their own outlets directly to wholesalers and retailers, but smaller ones have to depend on traders who collect from a number of producers. A simplified market structure for egg and poultry meat sales is shown in Figure 7.3. The poultry shop is particularly important as an input supplier for smaller commercial farms.

Figure 7.3. Market structures for egg and broiler products



The egg and broiler industries have grown in parallel with the development of the commercial livestock feed industry. This relationship is very close because many of the large feed mills own breeder flocks and hatcheries and distribute day-old chicks (DOC) as well as poultry feed, equipment and supplies. Both feed products and DOC are distributed to small producers through poultry shops in and around the major cities. Both of these inputs are sold direct to large poultry producers.

Poultry co-operatives are one form of operation that has evolved to solve farmers' problems. Through this organization, farmers may substantially reduce their dependence on other agents for inputs. However, poultry co-operatives that were pioneered by the government cannot survive. Hence there is a need to revitalize farmer groups and poultry co-operatives through a better strategy and approach. It is important to create synergy through equal and parallel partnerships with large-scale poultry companies. Poultry co-operatives should not only focus on raising animals, but should also become involved in post-production marketing.

The global market should be an international market, free from government intervention. This would mean that every country would be open to imports and the local products would be able to be exported. Materials and services would flow according to market forces. Therefore every country has to be prepared so that local products can at least share in the local market, and also compete in the world market. Poultry products are global products and not limited to a few countries because technology gives every country the opportunity to supply eggs and broilers. In the last ten years, Indonesia has been spectacularly successful in becoming self-sufficient in broiler and egg production although the poultry industry is not ready yet to face globalization.

The best partnership pattern occurs when a national poultry industry is reorganized, making use of comparative advantage and producing good quality outputs. Therefore, the national poultry industry has to be vertically integrated with streamlined operations. The objectives of national policy are to determine the minimum and the maximum sizes of each farm, consistent with the availability of feed ingredients and local agricultural products.

The development of a partnership operation involves technical aid that can increase the productivity of smallholders. Increase in productivity is indicated by a good feed ratio. The

smallholders' increased productivity is a good basis for a business partnership, because such a partnership can improve efficiency. Smallholders in Indonesia have been the backbone of livestock production, specifically in the rearing business. Therefore, if the target is to build an efficient livestock production system, smallholders need to be in partnership with large modern companies.

The period 1972-1980 is referred to as the broiler and layer growth phase. Furthermore, because of competition in production between the small poultry businesses and large businesses, a number of government regulations were issued: (a) Presidential Decree No. 50/1980 limited the broiler and layer business; (b) Presidential Decree No. 22/1990 expanded the scale of smallholder business, and set other rules for big poultry companies. Based on the decree, the nucleus scheme partnership in the broiler business was established with the following principles for both parties:

- the nucleus company is responsible for providing production inputs, guaranteeing the price at harvest, supporting capital requirements, providing guidance and technical services, and paying for chicken products within fourteen days;
- the smallholder is responsible for providing land and housing for 5 000-15 000 chickens, providing equipment, following production processes with special parameter targets that have been agreed upon, and selling all production to the nucleus company.

To guarantee that the smallholder bears the smallest business risk, a safety regulation is made in the agreement; namely (a) an income guarantee of 5.8-6 percent of the total costs, and (b) a fixed price based on the components of production costs and income guarantee. If the market price of production is higher than the fixed price, the farmer receives a bonus of 20 percent of the balance. If the market price of production is lower than the fixed price, the buying price is the price guarantee. For example, in a broiler business where production averages 1.7 kg per chicken:

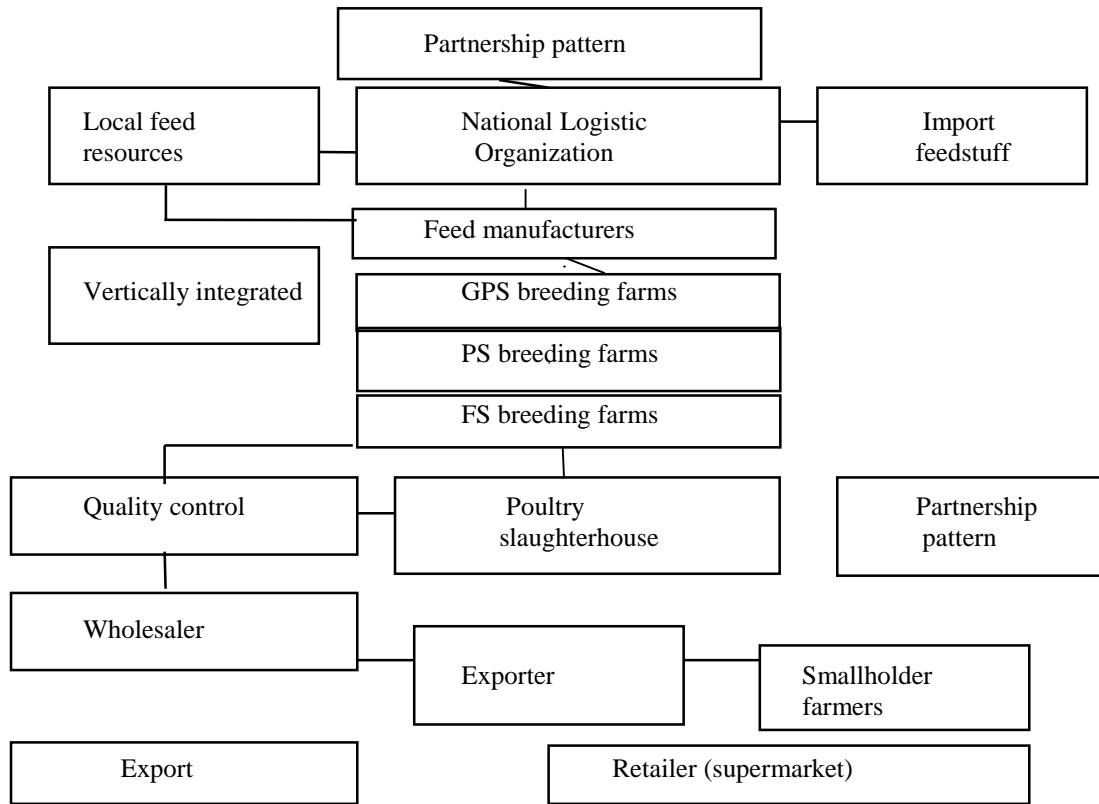
- the farmers' investment for a housing area of 500 m² and equipment is almost Rp. 13 million for 5 000 broilers. Based on this cost, the depreciation of one chicken is Rp. 51 and the bank interest (16 percent per annum) is Rp. 69 per chicken.
- the farmer's income per cycle is almost Rp. 1.9 million. With an average of 5.7 cycles per year, an estimated annual income in a broiler business is around Rp. 10 million.

An alternative partnership pattern of poultry business is given in Figure 7.4. The partnership in poultry has so far involved 67 nucleus companies and 2 000 farmers.

CONCLUDING COMMENTS

In order to produce hygienic and wholesome products for customers, the establishment of meat processing plants in Indonesia should be in line with The Decree of Minister of Agriculture No. 555/Kpts/TN.240/9/1986 on the Requirement for Abattoir and Abattoir Enterprises, and with the Decree of Minister for Agriculture No. 413/Kpts/TN.310/7/1992 on Slaughtering of Domesticated Animals and Handling Procedures for Meat and Offal.

Figure 7.4. Alternative marketing channels of poultry businesses through a partnership pattern



Source : Yusdja and Saptana (1995)

Slaughterhouse management can be improved by transferring public slaughterhouse management to private enterprise, with the exception that meat inspection regulations and control over slaughterhouse hygiene and sanitation must rest with the local government under the technical supervision of the DGLS. The alternative would be to upgrade selected slaughterhouses to modern standards of hygiene and public health. The majority of slaughterhouses could be turned over to private sector management with the DGLS retaining authority over slaughterhouse hygiene, sanitation and meat inspection as well as the food safety and inspection services programmes. The profit motivated private industry would gain more incentive to maintain quality standards, thereby improving the product quality. Private industry, concerned with meat quality, could help to modernize the transport of slaughter animals (cattle, buffalo, sheep, goats, and pig) from the farmers or markets to their holding grounds. As profit depends on marketing techniques, the consumer will benefit through increased competition between the markets.

Livestock product marketing is in general satisfactory, and conditions for competition between traders exist in most markets. Depending upon market volume, new market sites could be established. The market information position of the farmers *vis-a-vis* the middlemen should be improved by developing a reliable livestock market information system. This would routinely yield market price data and production projections, based on the periodic

verification of livestock numbers and production. Market prices should be broadcast and published daily. The national poultry industry has to become vertically integrated with up-to-date facilities.

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8. CLASSIFICATION OF INDONESIAN DAIRY CO-OPERATIVES

Paul Riethmuller and Dominic Smith

Department of Economics, The University of Queensland, Brisbane, Australia

Farmer co-operatives play an important role in the Indonesian dairy industry. As explained in Smith and Riethmuller (1995), they collect milk from dairy farmers for sale to processing companies, provide credit to farmers and offer extension advice. The dairy co-operatives that are members of the GKSI (Union of Indonesian Dairy Co-operatives) are placed by the Ministry of Co-operatives into one of five classes. These range from non-active to strong. The perceived success of dairying in various regions of Indonesia is based upon the rankings achieved by the dairy co-operatives in that region. The Ministry of Co-operatives is the government ministry responsible for overseeing the operations of Indonesia's co-operatives. Co-operatives that the government views as successful under the classification system may be encouraged to expand or be granted extra credit for cattle purchases. Those that the government perceives to be weaker may not be given the same level of support.

This chapter analyses the current system of co-operative classification and highlights its advantages and disadvantages. Two alternative productivity-based classification systems are proposed. While these alternative classification systems are not necessarily better than the existing system, they are presented to contribute to the discussion about how best the government should classify Indonesian co-operatives.

CURRENT CLASSIFICATION SYSTEM

The current system used by the Ministry of Co-operatives for classifying Indonesian dairy co-operatives is based on the daily milk production of the co-operative, its gross daily output, averaged over a three year period. Table 8.1 shows the classification levels currently in use.

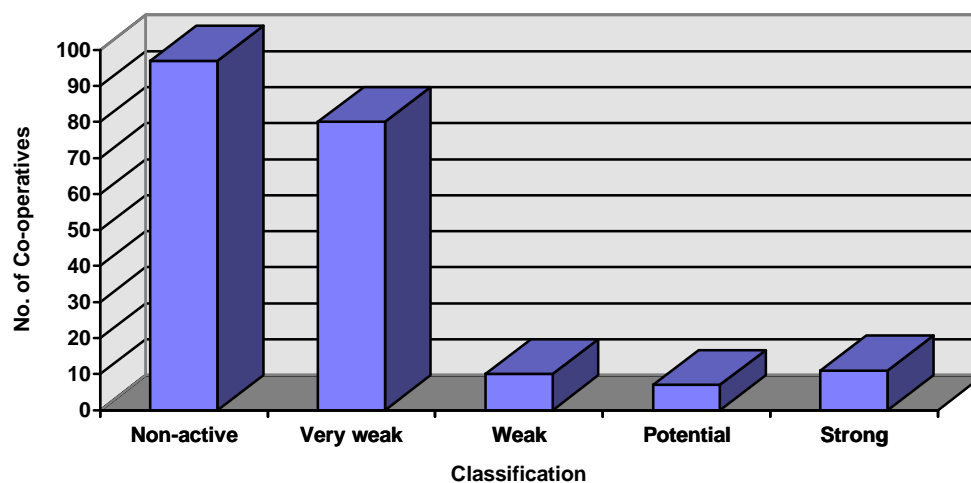
Table 8.1. Existing classification criteria

Milk production (litres/day)	Classification
more than 20 000	Strong
10 000-20 000	Potential
5 000-10 000	Weak
less than 5 000	Very weak
0	Non-active

Source: GKSI (1995)

Applying the criteria of Table 8.1 to the 1994 production data for Indonesian co-operatives provides the results shown in Figure 8.1. As the figure shows, of the 205 co-operatives that are members of the GKSI, over 86 percent are classed either as non-active or as very weak.

Figure 8.1. Status of Indonesian dairy co-operatives, 1994



As this classification system is based purely on gross milk production per day, it is heavily biased towards large-scale co-operatives with many farmers and cattle. Although Figure 8.1 presents what seems to be quite a dismal picture of the state of Indonesian dairy co-operatives, it may well merely be a reflection of the size distribution of co-operatives. The vast majority of Indonesian dairy co-operatives are small-scale operations, and although they might be technically efficient, they could be classified as weak or very weak using the criteria of the Ministry of Co-operatives. Of course the co-operatives classified as non-active (almost 50 percent of the total) would be non-active under any classification system. The following two sections present alternative classification systems, based on productivity measures rather than on gross output levels. Non-active co-operatives are not included in these two alternative classifications.

PRODUCTION PER FARM AS A CLASSIFICATION CRITERION

Unlike the previous classification system, one alternative classification is based on the average milk production per farm within each co-operative. This classification system can assist policy makers identify those co-operatives that have a high productivity per farm and help them identify the reasons for various levels of performance. The classification criteria are shown in Table 8.2.

Table 8.2. Farm productivity based criteria

Criterion (litres/farm/day)	Classification
0-5	A
5-10	B
10-20	C
over 20	D

Figure 8.2 shows the co-operatives classified according to the criteria of Table 8.2. It is immediately obvious that the distribution of co-operatives when classified according to production per farm is far more even than the distribution gained using the gross production from the co-operative. Figure 8.2 does not show, however, whether the productivity and gross output-based criteria give similar rankings to the co-operatives.

Figure 8.2. Co-operatives classified according to production per farm, 1994

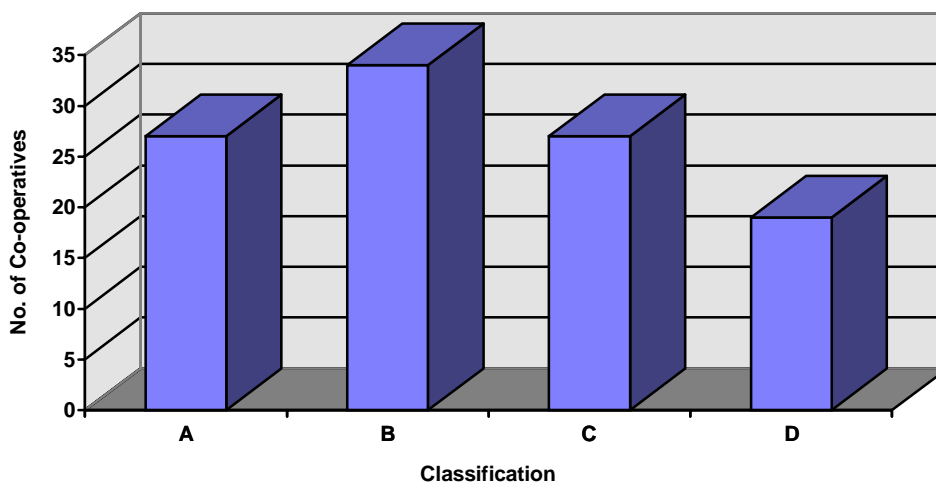
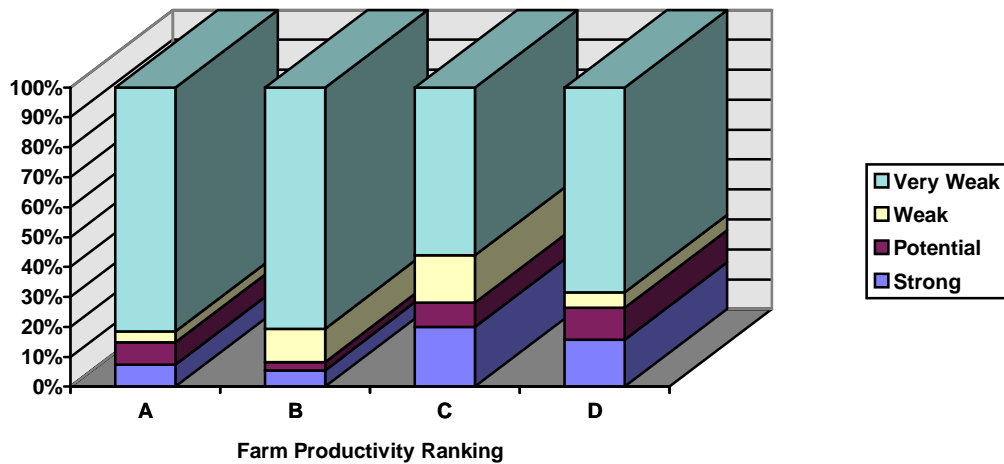


Figure 8.3 shows the proportion of co-operatives in each farm productivity criterion ranked in their original (gross output) classes.

Figure 8.3. Comparison of farm productivity and gross output-based rankings



The following points may be made from the information presented in Figure 8.3.

- Highly productive co-operatives (Category D) – those where the average farm produces more than 20 L per day – do not necessarily have a high gross output.
- Low output co-operatives – these are the co-operatives classified as very weak on the basis of gross output – could have members able to produce a very high output per farm.
- Co-operatives where the average farmer is able to produce ten or more litres of milk per day (categories C and D) are less likely to be classed as very weak or weak on the basis of daily gross output than those co-operatives where the average farmer produces less than 10 L per day.

A problem with using this approach to rank co-operatives is that it is biased toward co-operatives that consist mainly of large farms. Thus a high output per farm may be achieved simply by having a large number of animals per farm.

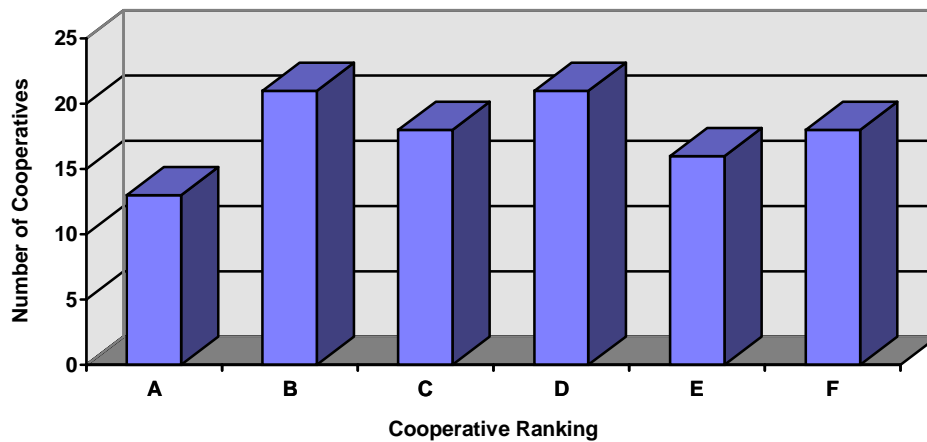
PRODUCTION PER ANIMAL AS A CLASSIFICATION CRITERION

To overcome any bias in favour of large farms, co-operatives can be ranked according to the output per animal per day. This gives a measure of the productivity of each animal, but does not take into account farm or co-operative size. Nor does it take into account the use of other inputs besides the cows, nor the quality of milk delivered. The distributions of co-operatives according to these classification criteria are shown in Table 8.3 and Figure 8.4.

Table 8.3. Criteria for ranking dairy co-operatives based on daily production per cow

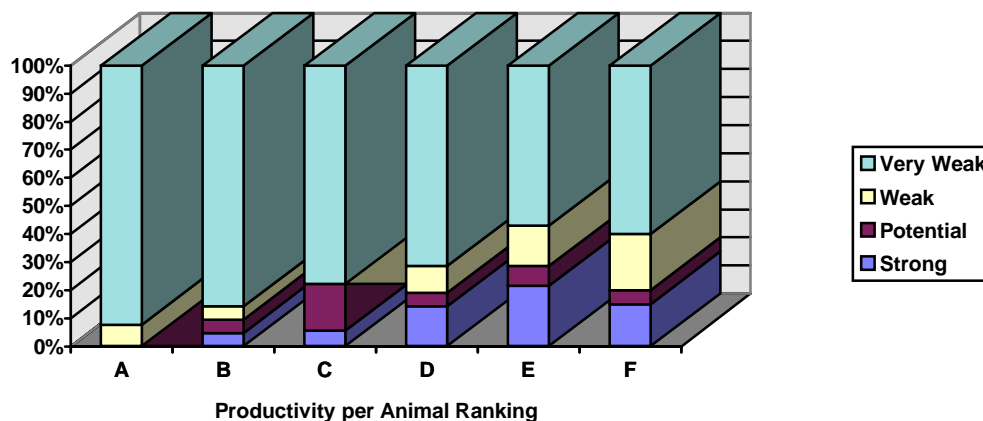
Output (litres/cow/day)	Ranking
0-1	A
1-2	B
2-3	C
3-4	D
4-5	E
>5	F

Figure 8.4. Co-operatives classified according to productivity per animal, 1994



Once again, the distribution of co-operatives according to productivity per animal is more even than the distribution according to milk output level. Figure 8.5 shows the proportion of co-operatives in each animal productivity class based on the currently-used gross output rankings.

Figure 8.5. Comparison of animal productivity and gross output-based rankings



It is apparent from Figure 8.5 that:

- although not as evenly distributed as it was with the farm productivity rankings in Figure 8.3, gross output is not highly related to productivity per animal; and
- over half the co-operatives ranked as having a per animal output of greater than 5 L per day were ranked as very weak in the gross output-based classification.

IS THERE A RELATIONSHIP BETWEEN THE RANKINGS?

To quantify the degree of agreement in the rankings provided by the three criteria so far described, Spearman rank correlation coefficients were calculated for the rankings of the co-operatives. The Spearman rank correlation coefficient (r_s) was calculated using the SPSS computer package. It enables testing of the hypothesis that the correlation between the rankings is significantly different from zero. A value of -1 for r_s means that there is perfect negative correlation between the rankings. A value of $+1$ implies perfect positive correlation while a value of 0 implies that there is no correlation. The Spearman rank correlation coefficients calculated using the three ranking systems are presented in Table 8.4.

Table 8.4. Calculated Spearman rank correlation coefficients, 1994 data

Rankings	Correlation coefficient	Significantly different from zero?
Per cow production and total production	0.25	Yes, at the 10 percent level
Per farm production and total production	0.18	No
Per farm production and per cow production	0.91	Yes, at the 5 percent level

The following points may be made from the results in Table 8.4.

- The weak positive relationship between the gross output ranking and the per cow production ranking may be a result of the larger scale co-operatives being able to provide a higher level of extension advice and veterinary care than the smaller co-operatives. This would increase production per cow.
- There is no statistically significant relationship between the gross output ranking and per farm ranking. This indicates that the co-operatives that are classified as weak using the current criteria may have farm members able to produce relatively large volumes of milk.
- There is a very strong positive relationship between the per cow and per farm productivity ranking criteria. The strong relationship between per farm and per cow productivity ratings could be explained by the fact that most Indonesian dairy farms have at most three to five milking cattle. Furthermore, there is very little variation in this farm size (Chai *et al.*, 1999). Thus it would be expected that farms with a relatively high level of production per cow would also have a relatively high level of production per farm.

CONCLUDING COMMENTS

Each of the classifications of co-operatives detailed above has advantages and disadvantages. The classification being used in the late 1990s focuses on co-operative size as a measure of strength, by ranking co-operatives on average daily gross output. This is useful for measuring the relative sizes of co-operatives, but does not take productivity into account and is biased toward large-scale co-operatives. The first alternative suggested focuses on productivity per farm. It is a useful tool for measuring the ability of the farm unit to produce milk, but it does not take productivity of animals or size of the co-operative into account. Moreover, this measure is biased toward those co-operatives that consist of large farm units. The second alternative is based on productivity per animal. Whilst avoiding the biases implicit in the first two approaches, it does not take into account farm size (and associated economies of scale) or the size of the co-operative. All of these are important factors in the success or failure of a dairy farming enterprise. A general criticism of all of the measures is that they ignore financial considerations, taking no account of the financial performance of the dairy operation, either at the farm level, or at the co-operative level.

A practical solution to the problems posed by the individual classifications outlined above may be to use all three together, to give an overall ranking based on co-operative size and infrastructure, farm productivity and economies of scale and productivity per animal.

The value of this approach is that it would enable the Indonesian Government to target co-operatives that are found to be weak in particular areas. For example, the total output of a co-operative is an important consideration when decisions are being made about the provision of capital. It would probably make most sense to provide cooling equipment or milk pasteurizing equipment to the largest co-operatives. Hence in allocating funds for this purpose, a ranking of co-operatives based on output would be a valuable adjunct in decision making. If, however, a programme to improve the on-farm technical efficiency was being set up, a ranking of co-operatives on the basis of output per animal would enable the poorest performing co-operatives – and those likely to be in greatest need of assistance – to be identified.

A criticism that is sometimes made of policy makers is that they try to use a simple policy measure to achieve a range of objectives. International trade is one area where this is likely to happen. Governments provide protection to a sector or industry to preserve foreign exchange, to maintain employment in the protected sector, for national security reasons and so on. The general principle that should be followed is to use various instruments to achieve particular objectives. The same philosophy should be used in the Indonesian dairy industry to rate co-operatives. No simple rating measure is likely to be useful for all policy issues.

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9. A STUDY OF COST STRUCTURES OF DAIRY CO-OPERATIVES AND FARMER INCOMES IN EAST JAVA

Yusmichad Yusdja, Bambang Sayaka

Centre for Agro-Socioeconomics Research, Bogor, Indonesia

Paul Riethmuller

Department of Economics, The University of Queensland, Brisbane, Queensland, Australia

Production of fresh milk in Indonesia has not increased very much in recent years and the level of production in the latter part of the 1990s is insufficient to satisfy the fast growing demand for this commodity. Around 90 percent of Indonesian fresh milk production comes from smallholder dairy farms. Problems faced by smallholder dairy farmers include lack of capital, low technology and insufficient human resources. On the basis of its performance to date, the dairy industry will not be able to meet the growing demand for milk that is sure to continue as Indonesia moves up the development ladder.

Most Indonesian dairy farmers are members of a co-operative. This can either be a milk producing co-operative (KPS) or a village co-operative (KUD). The farmers obtain cattle and feed through the co-operative, on credit. They also sell their fresh milk to the co-operatives. Co-operatives are agencies that integrate the economic power of dairy farmers in the market for inputs and outputs. Therefore, co-operatives have an important role to play in improving efficiency and increasing dairy farmers' income.

The co-operatives face some problems in dealing with dairy farmers. These problems include low levels of productivity and the inability of the operators of small farms to increase herd sizes. The most pressing problem is the seeming inability of the co-operatives to develop the smallholder dairy farms into economically successful businesses.

The objective of this chapter is to present information on the cost structure of co-operatives (KUDs), and in particular to analyse the dividends distributed to their members. It also attempts to analyse how the KUDs determine the price of fresh milk received by the farmers.

Specifically, it describes the cost structure of the KUDs in one budget year and examines whether or not the cost structure influences farm-gate price and farmer's dividend.

CONCEPTUAL FRAMEWORK

Most of the following discussion is based on Sri-Edi Swasono (1985). Basically, KUD operations are governed by two principles. First, KUDs operate their business with the broad objective of minimizing costs or maximizing benefits to the member farmers. Second, KUDs help their members to obtain lower-priced inputs and at the same time to obtain a selling price for the farm output that is as high as possible.

If KUDs applied the principle followed by private companies, they would operate their businesses to gain the maximum benefit for the KUDs themselves but not for other firms co-operating with the KUD. These include firms that supply goods and services to the co-operatives and also the dairy farmer members. Such a philosophy would encourage KUDs to behave in a monopsonistic manner and dictate a price to member farmers and other input suppliers. If KUDs followed the principle of obtaining the lowest price inputs, they would help the smallholders earn maximum possible profits. This implies that costs would be kept to a minimum. Under the second approach, the KUDs would make an economic profit and this would increase as smallholder participation in dairying grew.

Each member of the KUD has an equal vote and important decisions are decided by a meeting of the members. If co-operatives were to behave as private companies, the shareholders would authorize the KUD officials to operate the business and the KUD profits would be distributed to the members. However, if KUDs were to operate as intermediaries between the dairy farmers and the processors, all decisions would need to be made by the members.

The KUDs prioritize their services to members. Problems can arise with respect to the businesses operated by the co-operatives and the services that the co-operatives provide to their dairy farmer members. The farmers, being reliant on the assistance of a KUD, expect it to minimize its operating costs. This would help the farmers achieve high levels of profits. On the other hand, KUDs also have their own economic objectives and expect that their members will help them achieve these objectives. One way in which the relationship between a KUD and its members can be examined is through the dividend or profit payment of a KUD. The profit received by KUDs from each business unit is distributed to the members at the end of year. The greater the profit, the greater the members' income. However, not all of the profit earned by the KUD is distributed to members. Some is retained by the co-operative.

METHODOLOGY FOLLOWED IN THE ANALYSIS

One approach that could, in principle, be used to investigate the economic characteristics of co-operatives would be to estimate either a profit or a cost function for a sample of co-operatives. To make such an estimate, information on profits (or costs) and input prices is required. However, that information is not available for a sufficiently large number of co-operatives for this approach to be used. Instead, the analysis assesses the cost structure of the dairy cattle unit and its position among the other business units in the co-operative.

To analyse the efficiencies of KUDs, a comparison is made between KUDs of different sizes. The analysis concentrates on the dairy cattle business unit, since this has a greater level of activity than other business units. Furthermore, for the sample that is examined, most of the members of the co-operative are dairy farmers. Besides cost structure, dividend payments generated from dairy cattle business units are assessed and compared with dividends from other business units. The analysis is entirely descriptive using concepts applied by Gittinger (1982).

The study was conducted in East Java, which is one of Indonesia's largest milk producing areas. As mentioned already, the units analysed are KUDs in which dairy farming is the largest business unit. The KUDs in East Java were stratified by total milk produced in 1994 and then 13 KUDs (or 20 percent of the population) were selected randomly (KUD Jawa Timur, 1994). The quantity of milk produced by the sampled KUDs is shown in Table 9.1 which also shows the quantity of milk produced by all KUDs in East Java. Forty-one KUDs in the population produced less than 5 000 L of milk per day. Nine of these were sampled. Thirteen other KUDs in the population produced more than 5 000 L milk per day, and four of these were sampled. None of the 11 co-operatives that are now inactive were sampled. Most of the KUDs in the sample (8) are located in Malang district and the rest are in Pasuruan district. Data were collected from interviews with the KUD officials and the managers of the dairy cattle units in each KUD, using structured questionnaires. Cost structures were analysed using information in the annual reports of the KUDs.

Table 9.1. Distribution of KUDs by daily milk production and the number of KUDs sampled in East Java

Group	Milk production (litre/day)	Number of KUDs in East Java	Total KUDs sampled
A	over 20 000	5	2
B	10 000-20 000	1	0
C	5 000-10 000	7	2
D	less than 5 000	41	
	a. 500		2
	b. 1 500		2
	c. 2 500		2
	d. 5 000		3
E	Non-active	11	0
Total		65	13

THE DAIRY CO-OPERATIVES

Characteristics of the KUDs

At the time of the study, there were 65 dairy co-operatives in East Java and all of these were members of the GKSI. As explained in Chapter 8, the KUDs are classified into five groups based on total production per year, namely strong (A), potential (B), weak (C), very weak (D), and non-active (E). The classification is based only on the ability of the KUD to produce milk; it does not consider the performance of farmers individually. It is possible that some dairy farmers of GKSI-group E (weak co-operatives) have better performance than those of group A (the strong co-operatives).

The KUD classification that is applied by GKSI, without regard for indicators such as productivity, production structure and efficiency level, suggests that the GKSI considers only total fresh milk produced by KUDs to be important. This may be so, because the GKSI income is mainly generated from dealing in fresh milk.

Table 9.2 shows the distribution of KUDs according to the existing classification. There are some interesting points, namely:

- 63 percent of KUDs have a relatively low total production of fresh milk, and are classified as very weak (D). Although this is the largest group of co-operatives in East Java, they only produce a small proportion of the fresh milk marketed to the GKSI. On the other hand, KUDs of groups A and B make up only about 10 percent of the total number of co-operatives but they produce 69 percent of the total production. Almost all the total fresh milk production of the GKSI in East Java depends on the five KUDs of group A.
- most (63 percent) of dairy farms belong to KUDs classified as group A. The strength of group A co-operatives does not necessarily derive from high productivity levels, but reflects the fact that these co-operatives comprise large farmer and cattle populations. In fact the cows of group C co-operatives were the most productive: they numbered only 9 percent of cows, yet were responsible for 14 percent of daily milk production.
- in general, to achieve a high level of production, the policy of the GKSI and the KUDs has been to increase total dairy co-operatives and total dairy farmers, and distribute more cattle to the farmers.

Table 9.2. KUD distribution by existing classification in East Java, 1994

	No. of units					Total
	Group A (>20 000 L per day)	Group B (10 000- 20 000 L per day)	Group C (5 000- 10 000 L per day)	Group D (<5 000 L per day)	Group E (0 L per day)	
KUDs	5	1	7	41	11	65
%	8	2	11	63	17	100
Farms	160 000	4 000	44 000	44 000	2 000	254 000
%	63	2	18	17	1	100
Dairy cattle	59 000	2 000	8 000	19 000	400	88 400
%	67	2	9	21	0.5	100
Milk output (L/day)	216 000	10 000	47 000	52 000	0	325 000
%	66	3	14	16	0	100

Source: GKSI, East Java Regional Coordinator

Trends in KUD characteristics

Table 9.3 shows the milk production of KUDs from 1992 to 1994. During this period there was generally no change in the composition of each group. Hence, during this period there was not much change in the level of fresh milk production. Two of the KUDs that were classified as group E in 1992 had shifted to other groups by 1994. One KUD moved into group A over the period covered by the table.

Table 9.3. Milk production in sample KUDs by existing classification, East Java

Group	Average production (litres per year)	1992	1993	1994	Growth rate 1992-1994 (%)
A	47 143 000	4	4	5	12.5
B	18 714 000	1	2	1	0.0
C	7 364 000	5	4	7	20.0
D	1 321 000	42	43	41	-1.2
E	0	13	12	11	-7.7
Total		65	65	65	0.0

Source: GKSI, East Java Regional Coordinator

Details on the ownership of milking cows in 1994 are shown in Table 9.4. The classification scheme used in Table 9.4 is not the same as the one used to classify co-operatives as strong, potential, weak, very weak or inactive. Instead, the classification is based on the milk production per farm. There were 179 farmers producing up to 500 L of milk per year (these

are group 1), and 1948 farmers producing 15 000 L or more per year (group 6). The ownership ranges from 1 to 2 head per farmer, but with most farmers only having one milking cow. For example, the 179 farmers in group 1 had a total of 72 milkers in 1994, while the 1948 farmers in group 6 had an average of one milker each.

Table 9.4. Cows per farmer, KUD members

Group	Production (litres/year)	Total farmers	Lactating cows	Dry cows	Total milking cows	Heifers	Total
1	500	179	0.1	0.3	0.4	0.5	0.9
2	1 500	6 225	1.2	0.2	1.3	0.3	1.6
3	2 500	789	1.3	0.4	1.7	0.1	1.9
4	4 000	599	1.5	0.3	1.8	0.4	2.3
5	10 000	928	2.7	0.5	3.1	0.7	3.8
6	15 000	1 948	0.9	0.1	1.0	0.3	1.3

Source: GKSI, East Java Regional Co-ordinator.

More details of the KUDs by group are given in Table 9.5. The following points can be gained from the information in this table.

- The number of dairy farmers has decreased by 1.4 percent per year over the three year period 1992-1994. Most of the decline occurred in group A. Here the cattle numbers fell by 2.9 percent per year. Farmer numbers in other groups remained relatively constant. This could be an indication that dairy cattle farming is not attracting farmers and that many farmers have experienced failure of their enterprise.
- The trend is for the cattle population to increase by 2.5 percent per year on average, with a range of 1.9-8.4 percent per year. However, total cows owned by farmers do not change, but remain at two to three head per farmer. Hence, the population increase does not influence average ownership significantly. Nevertheless, the production increase per farmer is 11 percent each year. The increase in production is due to population increase and is not caused by productivity increase. The rate of productivity increase for the three years is 6.5 percent from 3.2 litres per head per day.

Some important conclusions can be drawn from the discussion above.

- Most of the KUDs are not particularly efficient in terms of production per cow. Also, the situation of the farmers is weak because of the low level of cattle ownership.
- Increases in fresh milk production are mostly due to increases in cattle numbers. Cattle productivity has made little or no progress.
- Indonesian dairy farmers have nowhere near the five to ten lactating animals that industry representatives believe farmers need to have if they are to be viable. On the basis of the 1994 population of cattle, farmer numbers would need to fall by 40-50 percent for the target to be reached.

**Table 9.5. Trends of farmers, cattle, and fresh milk production of KUDs
in East Java, 1992-1994**

Item	1992	1993	1994	Growth rate 1992-1994 (%)
Group A				
- Farmers	14 894	14 045	14045	-2.9
- Dairy cow population	53 069	53 300	55036	1.9
- Production (L)	178 771	191 952	194992	4.5
- Production/farmer (L)	12.0	13.7	13.9	7.8
- Production/cow (L)	3.4	3.6	3.5	2.6
- Cows/farmer	3.6	3.8	3.9	5.0
Group B				
- Farmers	1 948	1 948	1 948	0.0
- Dairy cow population	3 928	3 785	3 785	-1.8
- Production (L)	16 232	19 295	20 616	13.5
- Production/farmer (L)	8.7	9.9	10.6	13.5
- Production/cow (L)	4.1	5.1	5.4	15.9
- Cows/farmer	2.0	1.9	1.9	-1.8
Group C				
- Farmers	3 416	3 416	3 416	0.0
- Dairy cow population	7 520	7 938	8 785	8.4
- Production (L)	30 919	38 323	41 214	16.6
- Production/farmer (L)	9.1	11.2	12.1	16.6
- Production/cow (L)	4.1	4.8	4.7	7.1
- Cows/farmer	2.2	2.3	2.6	8.4
Group D				
- Farmers	6 759	6 874	6 870	0.8
- Dairy cow population	20 416	20 960	21 504	2.7
- Production (L)	48 039	58 279	68 075	20.9
- Production/farmer (L)	7.1	8.5	9.9	19.7
- Production/cow (L)	2.4	2.8	3.2	17.3
- Cows/farmer	3.0	3.0	3.1	1.8
Total				
- Farmers	27 017	26 283	26 279	-1.4
- Dairy cow population	84 933	85 983	89 110	2.5
- Production (L)	27 3961	307 849	324 897	9.3
- Production/farmer (L)	10.1	11.7	12.4	11.0
- Production/cow (L)	3.2	3.6	3.6	6.5
- Cows/farmer	3.1	3.3	3.4	3.9

Source: GKSI East Java Regional Coordinator

STRUCTURE OF PRODUCTION COSTS AT KUD LEVEL

Dairy cattle business unit

All KUDs surveyed have about 15 business units and usually the dairy cattle unit is the biggest unit. The KUDs are also involved in milk processing, feedstuff processing and supply, fertilizer provision, saving and credit, electricity payments, the operation of a general store, native chickens and rice production.

In regard to the dairy cattle business unit, the KUD does not have the primary responsibility for its operation. Rather, the day-to-day running of the dairy farms is the responsibility of the farmer members. The KUD collects the fresh milk, processes it and then markets it to processing industries, and in some cases direct to the general public. The relationship between the KUD and its members is that of buyer and seller, and there is no contractual agreement between them. The farmers are free to make decisions relating to their own farm businesses.

The farmers are independent milk producers because they have to decide anything related to their businesses by themselves. On the other hand, the farmers pay for the services of the KUD and take all risks of their business. The KUD is the biggest buyer of the fresh milk produced by the farmers. Although the farmer is under no contractual obligation to do so, in practical terms all farmers have to sell their fresh milk to the KUDs to which they belong. They are unable to sell the milk to other KUDs because of the impracticability of transporting milk over long distances. Therefore, in theory, the KUDs are in a monopsonistic position in determining fresh milk prices. In practice, the GKSI and KUD decide the milk price at farm level. If the farmers were independent, they would be able to sell their own fresh milk to the milk processing industries directly and it is possible that they would get a higher price. The milk is sold by the GKSI to processors. The milk processing industries determine the price of fresh milk bought from the GKSI, not the farmers or KUDs.

Cost structure

As mentioned previously, the 13 KUDs were selected using stratified random sampling. Six strata were defined on the basis of daily production: 500 L, 1 500 L, 2 500 L, 5 000 L, 10 000 L and 15 000 L.

It can be seen from Table 9.6 and Table 9.7 that the cost to the KUD varies from Rp. 60 to Rp. 147 per litre of fresh milk. This is due to variation in policies implemented by the KUDs in taking the fees. The total fees depend on activities of the KUD. With the exception of the two smallest co-operatives, the fees tend to decrease as the production increases.

Due to the fees taken by the KUD, the farm-gate price of fresh milk ranges from Rp. 475 to Rp. 525 per litre (Table 9.6). On the other hand, the fresh milk price set by the processing industries varies from Rp. 588 to Rp. 660 per litre. The price variation is due to differences in the quality of the fresh milk produced by the farmers. Thus, the farm-gate price is not determined by costs of dairy farming and therefore the farmers may not cover costs.

The quality of the fresh milk depends on its density and fat content. The higher the fat content, the higher the price of fresh milk. However, it is difficult to implement a fresh milk price based on this quality. Fat content and water content are recorded every morning and afternoon at the collecting points, but the price of fresh milk is decided once a month or, in

some cases, every two months. When the processing industries receive a milk shipment they measure the fresh milk quality on all the milk – it is not measured for each farmer. Thus, the price set by the milk processing industries is the price received by the GKSI and transferred to the KUDs. The KUDs then pass on this price to the farmers, less costs.

The costs incurred by the KUDs for all their businesses are met by the dairy business unit, regardless of whether the business is related to the dairy farm. This will be discussed in the next section.

Returns to the KUD from the milk business range from a loss of Rp. 35 to a profit of Rp. 16 per litre of fresh milk. The economic scale of the KUDs does not seem to affect the level of their profits.

Table 9.6 shows that three groups are making losses: the smallest (500 L per day) and the medium-size KUDs (2 500 L per day and 4 000 L per day). In each annual report of the KUD, almost all dairy cattle business units are profitable, but KUDs generate losses overall. This is due to the costs expended by KUD to carry out all their activities. Obviously, the co-operatives do not produce these milk volumes exactly on any particular day. Rather, the production levels used to stratify the KUDs are approximate and represent “average” daily production.

Table 9.6. Average cost and profit received by KUDs per litre of milk, by daily production of the KUD, 1994

Item	Daily production					
	(500 L)	(1 500 L)	(2 500 L)	(4 000 L)	(10 000 L)	(15 000 L)
Cost	144	60	147	129	119	110
Farm-gate price	479	521	475	492	525	519
Total costs	623	581	677	621	644	628
Return	607	588	642	602	660	635
Profit	-16	8	-35	-19	16	6

Table 9.7. Percentage distribution of costs per litre of fresh milk by daily production of KUDs

Item	Daily production					
	(500L)	(1 500 L)	(2 500L)	(4 000L)	(10 000L)	(15 000L)
Salaries and bonus	12	21	22	18	18	15
Organization and administration	30	36	2	1	19	15
Buildings and vehicles	21	14	5	9	29	14
Depreciation	13	0	13	13	6	5
Service of postharvest	10	18	1	0	0	2
Electricity and telephone bills	5	0	2	0	0	4
Technical services	7	5	0	0	0	9
Interest rate, debt, tax	3	0	46	31	20	16
Inv.	0	0	5	0	7	10
Others	0	7	3	27	0	9
Total (%)	100	100	100	100	100	100
Cost (Rp./litre)	144	60	147	129	119	110

Profit allocation

To gain an idea of how the profits of the dairy business unit fit in with the total profits of the KUDs, it is necessary to have details of all KUD activities. Table 9.8 shows the costs, revenues and profits of each business unit of the KUDs. These KUDs operate 13 businesses. Not all of the businesses earn profits; in fact only six units are profitable and the rest generate losses. The profit gained by the dairy cattle business unit is the greatest at Rp. 220 million. On the other hand, profits of other units are relatively small.

Even though the profit of the dairy cattle units is Rp. 220 million, it is not distributed just to the dairy farmers. The profit belongs to the KUD and the KUD officials may use it for other activities or distribute it to all members. Thus the profit gained by the dairy cattle unit might be used to cover the losses in other business units. Overall profit of the average KUD is Rp. 41.8 millions. When costs expended for other activities are calculated in the costs and returns of the KUD, the profit of the dairy business unit can be negative, as Table 9.6 showed.

Not all the profits of KUDs are distributed to the members. Some are allocated for education, social development and other such activities. The KUDs generally use the profits more to operate the business of the KUD than to improve the farming operations of the members. This is in accordance with the business principles of the KUDs. If the profit of the dairy business unit were to be distributed to the dairy farmers, they would get an income increase of up to Rp. 280 000 per year. Furthermore, if the costs of the dairy business unit were to be minimized, the farmers would receive a higher level of income. The KUD policy of separating the business of the members and that of the KUD results in low incentives for dairy farmers. It makes them reluctant to improve production and to develop their farming operations.

Table 9.8. Distribution of income, costs and profits of KUD business units

Business unit	Income	Operating costs	Admin & general costs	Other costs	Total costs	Profit
	(Rp. '000)	(Rp. '000)	(Rp. '000)	(Rp. '000)	(Rp. '000)	(Rp. '000)
Fresh milk	2 261 044	348 112	132 014	1 559 979	2 040 104	220 940
Electricity	9 382	7 373	899	0	4 272	5 110
Price	111 908	472	83	106 909	107 464	4 444
Soybean cake	11 137	958	1 807	4 455	7 219	3 918
Credit	7 356	2 827	2 558	0	3 385	1 971
TVRI tax	3 045	1 535	300	0	1 836	1 209
Sugar	30 718	2 496	307	27 819	30 622	96
TRI	411	461	65	0	526	-114
KUT	240	3	366	0	369	-129
Food	41 595	3 159	191	38 466	41 817	-221
Fertilizers	126 080	6 498	647	121 241	128 386	-2 306
Cipro	267 630	5 668	44	275 221	280 933	-13 303
General	15 612	99 207	88 313	7 852	195 372	-179 760
Total	2 886 159	478 768	227 593	2 141 943	2 842 305	41 855

CONCLUSION AND POLICY IMPLICATIONS

In East Java during the three-year period 1992-1994, there were 65 KUDs, of which 80 percent were either very weak or inactive. There was little or no increase in total members or in the cattle population. Most dairy farmers had only one lactating cow with a production rate of 3 000 L per year or less. This is the main reason why milk production levels in East Java have only grown slowly.

At the KUD level, these are some of the findings.

- Total costs for fresh milk production vary among KUDs and there is no clear relationship between scale and expenses. It could be concluded that the KUD business may not be efficient and that there are a number of different structures in different KUDs.
- As milk production increases at the KUD level, the profit per litre tends to decline. Therefore, the farmers are not encouraged to expand milk production. The KUDs apparently prefer to increase total members and total cattle than to expand the ownership of cattle per farmer. This policy is more profitable for KUDs because total production of milk is their main concern. The KUDs seem to pay little attention to productivity at the farm level.
- Cost structures of KUDs do not help farmer profitability. The relationship between the KUDs and their membership is based on economic principles and it seems to cause the KUDs to behave in a monopsonistic fashion.
- The profits from the dairy cattle business unit are not distributed to the farmers. The KUDs have many activities involving a range of inputs and a variety of different outputs.

Profit distribution is under the authority of the KUD and its management is not obliged to return the profits from the dairy business to the farmers in that industry.

- There should be a policy in which a KUD has to operate one business unit only, for example dairy cattle, and all the members should be dairy farmers. On the basis of the information presented here, farmers would have higher profit levels. These profits should be distributed to the farmers in accordance with the volume of milk the farmer delivers to the KUD. Profits generated by dairy farming would not be lost to the farmers in the industry through the co-operative cross-subsidizing of less profitable business units. An alternative to having the co-operative specializing only in dairying would be to operate each business unit separately from other business units. This would require tight financial control at the co-operative level to ensure costs are assigned to the enterprise that incurs them.
- The KUDs now operating need to restructure their business units. The units making losses should be carefully investigated to identify areas where cost savings or productivity improvements could be made. If these units continue to operate at a loss, they should be closed down, unless there are good social reasons for their continued operation.
- Determination of the farm-gate price of fresh milk has to be based on milk quality and the price that the processing industry is prepared to pay. Cost determination at KUD level should be approved by the members and given legal status by the government. This system could mean that the farmers receive a better price and the co-operatives have a better chance of being profitable.
- When initiating programmes to increase the production of milk, the GCSI and KUD should not focus on merely increasing milk production via increasing the number of farmers and cattle. Rather, the focus should be on encouraging existing farm units to operate more efficiently and produce a higher level of output without increasing cattle numbers.

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10. INTERNATIONAL TRADE IN LIVESTOCK, LIVESTOCK PRODUCTS AND LIVESTOCK INPUTS

T.D. Soedjana

Research Institute for Animal Production, P.O. Box 221, Bogor, 16002, Indonesia

Smallholders' farms account for 95 percent of the total livestock population in Indonesia, while large-scale private enterprises account for the remaining five percent. Large-scale poultry farming, pig farming and, recently, beef cattle fattening on feedlots are most attractive to private sector firms. Accordingly, government policies towards increasing livestock production have focused on smallholders. The objectives of the livestock development policies have been to improve income, to develop exports and to reduce imports through substitution, to provide rural employment and to improve the nutritional status of the population.

With increased global interdependence, the impact of domestic livestock policies of a country like Indonesia could be transmitted to neighbouring countries in the region or even to the rest of the world. Domestic policies that could influence other countries include those that affect trade in livestock products and the consumption of livestock products, as well as macroeconomic factors such as fiscal and monetary policies. To gain more benefit from the livestock, livestock production and livestock inputs that are being traded between countries at the regional or international market level, it becomes necessary to identify the interests of each country, particularly if regional economic co-operation is to be promoted.

Analysis of international markets can conveniently begin with the standard concepts of supply and demand for a particular commodity. A country can produce low-priced products if it is favourably endowed with resources (leading to low costs) or if it has low domestic demand relative to domestic supply. This country can produce more than domestic consumers buy. Therefore, the excess supply of this country can be viewed as the supply of exports onto the world market.

Government intervention in the livestock sector has a variety of objectives. It can enhance prices and income for producers, as a way of subsidizing consumer prices and as a source of taxation revenue. Intervention, whether in exports or imports, alters the country's interface with world markets and therefore alters conditions in world markets as seen by other

countries. Two impacts can be distinguished: (1) the effect on the world price level, and (2) the consequence for world price stability. The impact on the price level depends upon the relationship between domestic and international prices. The stability effect arises from the extent to which the domestic price is fixed by policy or is allowed to react to changes in the world price level.

Governments of developing countries such as Indonesia, in response to high inflation rates, intervene in the food markets by enforcing price controls or subsidizing various products to keep retail prices low. Livestock products such as meat, milk and eggs are important in family expenditure, so changes in the prices of livestock products have a major impact on the cost of living.

Needless to say, the livestock sector in Indonesia plays an important role in the national economy: its contribution to the national agricultural sector has reached at least 10 percent per year and continues to increase even when the agricultural sector's contribution to Indonesia's economy has declined. However, until recently Indonesia has been classified as a net importer of beef feeder stock and dairy products as well as feed ingredients such as corn and soybean. Indonesia also imported poultry products during the period 1969-1984. Since then, Indonesia has become self-sufficient in eggs and broiler meat as a result of the poultry Mass Guidance Programme (*Bimas*) that was launched nationally in about 1979. Until 1990, domestic beef production satisfied demand, but imports of meat and feeder cattle began to increase in 1991. Domestic milk production has only been able to satisfy 35 percent of the national demand and about 65 percent of the supply is imported.

Demand for livestock products in Indonesia has grown because the income elasticity of demand for livestock products (meat, eggs and milk) is high. Empirical evidence indicates that as per capita income rises carbohydrate consumption declines and animal protein consumption increases.

The Government of Indonesia has anticipated the trend to a shortfall in the demand and supply of livestock products by issuing new regulations and by de-regulating the trade and domestic production of livestock and feed grains. This has been done to provide incentives to producers and to protect consumers from the impact of price fluctuations. As examples: (a) commercial credits can be obtained by individual farmers from the bank, (b) *Bantuan Presiden (Banpres)* or presidential aid, presidential instructions (*Inpres*) and cash programmes are provided for smallholders and poor farmers, (c) there are government programmes on livestock development, and (d) some livestock projects are funded through foreign aid.

INVESTMENTS IN THE LIVESTOCK SUB-SECTOR

The complexity and length of time required for licensing have slowed investment in the livestock sub-sector. The level and growth rate of investment in livestock in Indonesia are considered low, although the only source of data on actual investment relates to large investment only. The BKPM (Investment Coordination Board) approves large investments, such as those that are seeking special consideration such as tax and import duty relief. In a recent four-year period, the levels of domestic investment (PMDN) recorded by BKPM in the livestock sub-sector were as follows: three projects, US\$61 million (1993); seven projects, US\$101 million (1994); five projects, US\$232 million (1995); and seven projects,

US\$207 million (1996). For the same period, foreign projects were as follows: one project, US\$46 million (1993); one project, US\$12 million (1994); two projects, US\$49 million (1995); and five projects, US\$86 million (1996).

Indonesia has banned the export of live animals since the 1970s when live cattle were exported to Hong Kong. Nowadays, the government allows only day-old chicks and pigs to be exported. During the late 1980s, when the international demand for small ruminants was strong, the government reconsidered its policy and permitted the export of live sheep and goats. This followed the signing of the IMGT (Indonesia, Malaysia, Thailand Growth Triangle) memorandum between the three countries. Imports of live beef and dairy cattle, feeder steers, breeding pigs, day-old chick parent stocks, and other poultry for consumption are permitted.

Exports of all livestock products declined from US\$68 million to US\$66 million, while imports of livestock and livestock products shot up from US\$219 million to US\$711 million in the five years 1991-1995. Of the 1995 imports, US\$109 million was for imported slaughter steers and US\$26.6 million for dressed beef and beef liver. In just two years, the number of slaughter cattle imported increased from 188 000 head in 1994 to 378 000 head in 1996 while beef imports increased from 12 700 to 26 100 tonnes

Poultry

Poultry exports have fallen because of the rapid growth in poultry consumption. Indonesia exports day-old chicks but the number has decreased from some 702 000 head in 1991 to 76 700 head in 1995. Imports of parent stock for day-old chicks increased from 254 700 head in 1991 to 1 500 000 head in 1995 because of the increase in domestic demand for poultry products, while imports of eggs for hatching grew from 11 900 in 1992 to 2 540 300 in 1995.

Cattle

Indonesia was a net exporter of live cattle in the 1970s. However, increasing demand for beef which is highly income elastic has lowered the national supply. The rate of increase in demand for beef has been faster than Indonesia's ability to produce beef and therefore meat imports have helped meet consumer demand. Imports of beef in Indonesia started in the 1980s in the form of fresh or frozen meat, boned and boneless, but these have slowed because of a greater supply of meat from the broiler and layer industry as a result of the *Bimas* programme.

The increase in beef consumption has also stimulated the fattening business which aims to produce meat through fattening feeder cattle imported from Australia. Imports of this type began in 1991 when around 12 000 head were imported. By 1996, 367 000 head were imported and these numbers continued to increase, reaching 407 000 head in 1997. Feeder steers are more uniform in size and quality, and supply is more certain than the supply of domestic cattle. Domestic cattle are scattered across Indonesia and they vary greatly in age and body size. The growth of feedlot operations based on feeder cattle imported from Australia resulted in a significant expansion of the industry from only five feedlot operations in 1992 to 41 in 1997. The increasing demand for feeder cattle from Australia reflects the inability of the local industry to supply feeder cattle.

In recent years, the liveweight price in Australia has only been around US\$1.30 per kg for Brahman Cross, US\$1.25 per kg for *Bos taurus*, and US\$1.20 per kg for culled cows. When

the exchange rate was Rp. 2 400 per US dollar, locally purchased cattle could not compete with imports. (The local cattle sold at Rp. 3 700 per kg liveweight.)

However, beginning in July 1997 when the exchange rate depreciated to Rp. 16 000 per US dollar in January 1998, feeder steer imports were no longer attractive. This was the case even for trading companies with partners in Australia who could therefore purchase directly from farmers. Direct purchase costs much less than purchase through the traders: for instance, the liveweight price from on-farm purchase could be as low as A\$ 1.10 per kg or US\$0.80 per kg. The trade in feeder steers is still uncertain because it depends on the exchange rate. At Rp. 5 000 per US dollar, the price from Australian traders was US\$1.05, which is equivalent to Rp. 5 250 per kg. This is more expensive than local cattle, which cost Rp. 4 800 per kg liveweight.

Sheep and goats

Some 30 percent of the world's small ruminant population lives within the Asian region. Export prices (FOB) for small ruminants vary between countries and over time. The highest FOB prices are in countries in Asia, particularly in the Middle East, while the lowest are in the Oceania countries, such as Australia and New Zealand. In general, assuming that the animals are uniform in terms of breeds and other characteristics, a low FOB price reflects a competitive advantage of these countries in the small ruminant trade. During the period 1989-1992, the import costs (CIFs) for small ruminant meat in world markets were relatively stable although there were small variations between countries. The highest CIF is found in the European countries. Information on CIF is very important for Indonesia in setting up a strategy to develop the small ruminant industry. If the domestic price were far beyond the CIF, it would be impossible to export without a subsidy. Some countries in the Middle East, particularly Saudi Arabia, the United Arab Emirates, and Syria, have been net importers of small ruminants. Their imports are the highest in Asia, and account for 11.7 million head or about 51 percent of the total world imports in some years.

In many regions of Indonesia, animals are an important component of farming activities, particularly for the smallholder. Year round, the farmers' needs are provided from food crop production, and animals are kept primarily as a way of storing capital or generating a cash income. The role of animals in a farm's activities is demonstrated by the small ruminants kept by most farmers on the island of Java. Sheep and goats are raised with minimal inputs and low maintenance costs. They use and recycle waste products from cropping activities. Furthermore, they have a relatively high reproductive rate and there is always a ready market for them. The productivity of small ruminants on-farm is low compared to that obtained at experimental stations. Thus, increasing on-farm productivity could enhance national efforts to increase rural income and raise the level of national protein consumption. Further, increased small ruminant productivity would have economic implications because so many smallholders keep them.

There are two specialized small-ruminant markets in Saudi Arabia: one is for complete rams, which are required for sacrifice, and the other is for fat-tailed sheep, for which there is a strong consumer preference. An interesting aspect of this market is the price for different classes of sheep and goats in Saudi Arabia. Australian sheep dominate the retail market and sell for about US\$48-58 per head; Turkish fat-tailed sheep retail for about US\$110 per head; and the local Nadzi or Awassi fat-tailed breed sell for more than US\$250 per head, or about five times the price of imported Australian sheep. These were the prices in the mid-1990s.

The CIF varies between countries, and fluctuates. The variability of the CIF can be due to breed, age and liveweight as well as the cost of freight and insurance. Similar reasons are probably behind price fluctuations over time, making the price of the live animal highly uncertain. It is possible that in the trading of live animals, an importing country, through its import association, can have a monopsony and can determine the price at the time when the animals reach the port of entry. Import costs per head in Saudi Arabia and Qatar in 1992 were US\$80.4 and US\$74.7, respectively, which were far higher than in other Middle Eastern countries such as Oman (US\$33.3), Yemen (US\$35.0), and United Arab Emirates (US\$42.0). As indicated earlier, the difference might be due to breeds, liveweight and other trade specifications. Information on the CIF price is very important for a country like Indonesia that is in setting up a strategy for development of small ruminant production. When the domestic price is far beyond the CIF, it is impossible for the country to become an exporter without an export subsidy.

Just as for the CIF, the FOB price (export price) for small ruminants also fluctuates between countries and over time. The highest FOB prices are found within Asian countries, particularly in the Middle East, while the lowest prices are found in Australia and New Zealand. In general, assuming that the animals are uniform in terms of breeds and other characteristics, a low FOB price reflects a comparative advantage and provides a competitive advantage in the world small-ruminant trade.

Prices for meat from the small ruminant sector are a different matter. The price of meat is more stable than the price of live animals and it varies little between countries. It is important to note that world meat imports have increased from 865 000 t in 1989 to 911 000 t in 1992, or by 1.7 percent per year. In 1992, European countries were the largest importers of meat, reaching 415 000 tonnes or about 45.6 percent of the world import share, followed by Asia (31.9 percent). The rates of increase of meat imports by European and Asian countries within 1989-1992 were 3.4 percent and 1.2 percent, respectively. Even with a low import share, African countries recorded significant increases in meat imports from 13 000 t in 1989 to 23 000 t in 1992, a rate of increase of 21.5 percent per year. Within the European countries, France and the UK have been the largest importers of small ruminant meat with import shares of 16.9 percent and 11.9 percent respectively. On the other hand, Iran (7.5 percent), Japan (7.3 percent), and Saudi Arabia (4.2 percent) are the largest importing countries in Asia.

Between 1989 and 1992, the CIFs in the world market for small ruminant meat were relatively stable compared to the CIFs of live animals, and there were only small variations between countries. The highest CIF prices were in the European countries while those in Oceania were the lowest.

Pigs

The government effort to push export of non-oil commodities in the late 1980s also led to consideration of the role of the livestock sector, particularly poultry and pigs, as sources of foreign exchange. Indonesia only allows poultry and pigs to be traded internationally as live animals. The export of pigs is feasible because the domestic demand for pork is lower than production capability. An agreement in the form of Notes of Understanding between Singapore and Indonesia in the live pig trade has created good prospects for in-country pig enterprises, particularly in North Sumatra. This is because of its cultural situation and its proximity to Singapore. In this agreement, Singapore imports live pigs from selected farms in Indonesia, while the operators of pig farms in Indonesia must co-operate with pig farmers in Singapore. To the qualified pig farms, a licence is issued by the Government of Indonesia through the Decree of Minister of Agriculture No. 406/Kpts/019/6/1980 on foreign investment.

The licence is issued after the farm meets technical requirements that accord with the regulation set by the Directorate General of Livestock Services (No. 775/Kpts/071/Deptan/1982).

Export of live pigs to Singapore developed after the 1980 decree was introduced. However, this has not always benefited the pig farmers because Singapore's market is also open to other potential exporting countries such as Malaysia, China, Thailand and Vietnam. The basis for competition is product quality. Three types of live pigs were to be exported: suckling pigs weighing 3-5 kg per head, weaned pigs weighing 60-70 kg per head, and finished pigs weighing 95-105 kg per head. Indonesia's weaned and finished pigs could not compete in quality and price with other countries, and so only suckling pigs continue to have a market in Singapore. The reason is that other exporting countries consider exports of suckling pigs to be less profitable than weaned and finished pigs. The advantages of concentrating on suckling pig production are three fold: (1) separation of suckling pigs from the sow stimulates faster mating (two and two and a half times a year); (2) barns are used for shorter periods; and (3) there is faster generation of income for the enterprise.

A problem with the export of weaned and finished pigs is also the effect of the oligopolistic market in Singapore which is dominated by transactions through auctions, and non-contract sales between pig farmers in Sumatra and buyers in Singapore. Frequently, the pigs sent to Singapore market do not go through the auction. Therefore, they have to be sold at whatever price can be obtained, instead of being taken back to Sumatra.

Although Sumatra, with a domestic resource-cost ratio of less than 1 (somewhere between 0.25 and 0.75), has a comparative advantage in the export of pigs to Singapore compared to other areas of Indonesia, its major market is the local market. Traditional pig farmers experience difficulties in obtaining export certificates. This has forced the traditional farmers to go out of business because they are unable to compete with large-scale commercially operated farms that also sell products to local markets. These commercial farms in turn have to face the fact that imported inputs, including breeding stock, will be more expensive. The exports of live pigs have shown a decreasing trend, from 284 000 head in 1991 to 161 000 head in 1995, while imports of breeding pigs decreased from 4 300 head in 1992 to less than 100 head in 1995.

LIVESTOCK PRODUCTS TRADE

Beef and mutton

Beef is considered a luxurious product for upper- and middle-income urban people, who on average consume five times as much as those in rural areas. Beef consumption is the second highest after chicken meat, and the trend shows continued increasing demand as the population grows. Beef imports increased from 1 867 t in 1991 to 7 259 t in 1995. In addition, offal (mainly liver) imports increased from 3 665 t in 1991 to 12 000 t in 1995. Beef exports were only about 20 t in 1993 and 1995.

Despite the growth in production of small ruminants as well as beef, good quality mutton is also imported to meet the demand of special hotels and restaurants. Mutton imports have been steadily increasing from 335 t in 1991 to 737 t in 1995. The export of small ruminant meat was about 200 t in 1994, after several small export volumes in the late 1980s.

Dairy

The need to develop the dairy industry is a classic economic situation to meet the domestic demand for milk. It is also in line with the government objectives of increasing farmers' income, spreading the distribution of income, creating employment opportunities, increasing foreign exchange earning, and improving the nutritional status of the population. The industry is also dominated by smallholder operations, through which income distribution and employment opportunities are created. Dairy farming has a high linkage multiplier effect with other industries because large amounts of dairy products are used as raw materials by other industries. Expansion of dairy production is expected to reduce imports of milk and milk products and lead to exports of processed dairy products when domestic production is high and is competitive in international markets. Because of this, the development of the dairy industry has become very important in terms of the balance of payments. Unfortunately, the dairy industry in Indonesia has not been competitive for all types of enterprises, but it has been one of the most rapidly growing parts of the livestock sector since its introduction in the 1970s to support the milk-processing industry. At the start, the milk processing industry in Indonesia produced only sweetened condensed milk. Later it added milk powder and liquid milk, both of which have since developed more rapidly.

Unfavourable climatic conditions, combined with poor dairy farming management and milk marketing, slowed down expansion of the dairy industry from Java, where the industry is concentrated, to other islands. The government imported large numbers of dairy cattle in the 1960s and 1970s to stimulate the industry, and established joint ventures with foreign companies. However, production continued to be stagnant due to technical and marketing problems. A major boost in production occurred in the 1980s when the government introduced a regulation that forced local processors to process domestic raw milk before they could get access to imported dairy products. The sharp rise in the number of dairy cows from 193 000 in 1986 to 302 000 in 1991, through the import of some 110 000 dairy cows from Australia and New Zealand between 1979 and 1990, resulted in milk production increasing from 204 000 t to 329 000 t.

Despite the increasing level of milk production, only 35 percent of milk comes from domestic production, with the rest being imported. This amounted to 533 000 t in 1993 and 1 026 200 t in 1995. The Government of Indonesia introduced four major regulations into the dairy industry: an import ratio, import tariffs, import licensing, and restriction on investment in the industry. However, with the latest presidential instruction (Inpres No. 4/1998), as a response to the 50 IMF commitment items, all of these regulations have been lifted. With the new Inpres, the dairy industry is expected to prepare itself for the open market sooner than was agreed upon during the APEC meeting in Bogor ('the Bogor Declaration') that set 2003 as the deadline.

Except during a short period covered by the regional monetary crisis, the high demand for milk and milk products has resulted in a local milk price that is far lower than the world market price. Hence, consumers are now looking at local fresh milk and pasteurized milk in place of powdered milk and other processed milks. In addition, the low exchange rate between the Indonesian rupiah and the US dollar has made domestic milk and milk product prices even lower. The question is whether or not this means that domestic milk production now has a greater competitive advantage than imported milk.

Broilers

Poultry farming is extremely important in the livestock sector in Indonesia, and the demand for poultry products is very high. However, the raising of broiler and layer chickens is relatively new to Indonesia, having started in the 1970s through the *Bimas* programme. The rapid increase in broiler production has outpaced beef production since 1979. At present, the domestic market for broilers has been saturated by the large volume produced in compliance with the national campaign to increase non-oil exports. This may be one of the reasons why the price of broilers has fallen drastically in recent years. Export of broilers is expected to increase each year. Statistics show some 213 400 t was exported in 1991, growing to 1 000 400 t in 1995.

Eggs

At the same time as broiler production was being developed in the 1970s, modern layer poultry farms producing eggs were also developing into highly specialized operations. There are high concentrations of layer chickens in West Java because it is close to large markets around the big cities, including Jakarta. The cities are the largest market for chicken eggs. Hence, the factories that supply inputs to farms, as well as the feed industries, are located near the production centres. Exports of eggs from Indonesia are small and negligible, and started in 1986. At that time, the production of eggs for consumption was only 6 t; it jumped to 55 t in 1987. This was an indication that Indonesia had the potential to export eggs, contrary to the situation before 1984 when Indonesia was a net importer of eggs for hatching, for fresh consumption, and for their yolks. Recent exports of eggs for consumption amounted to 959 500 eggs in 1991 decreasing to 198 200 eggs in 1995, while exports of eggs for hatching fell from 1 756 300 eggs in 1991 to 737 500 eggs in 1995. The reduced volumes for export were due to increased domestic demand for eggs for consumption as well as increased demand for hatching eggs.

Leathers, bones and horn

Livestock products in the form of skins, mainly from ruminant animals, are a prospective export commodity. Exports increased from 1 578 t in 1991 to 2 958 t in 1995, while bone and horn exports decreased from 4 124 t in 1991 to 1 706 t in 1995. The increase in skin exports is indicative of the increasing number of ruminant animals being slaughtered. However, imports of leather have been extremely high; they increased from 10 186 700 sheets in 1991 to 162 550 600 sheets in 1995, valued at US\$100 206 700 and US\$347 136 400, respectively.

LIVESTOCK INPUT TRADE

Livestock feed generally takes the form of forages, agricultural by-products and concentrate feeds. Ruminant animals such as beef cattle, sheep and goats, buffalo, and dairy cattle are raised on forage-based operations, although the fattening of beef cattle, sheep and dairy cattle also uses concentrate feeds. Poultry and swine enterprises use concentrate feeds composed of basic ingredients such as corn, soybean, rice bran, cassava, wheat pollard, fishmeal, meat meal and crude palm oil.

Government intervention in the feed industry in the past was only concerned with rice (which indirectly influenced rice bran production), corn, soybean and cassava. Floor pricing was

introduced for corn and soybean at the farm level but not for cassava. With new regulations, only rice is subject to government intervention through the National Logistic Agency (BULOG). Domestic rice production has been provided with input subsidies, price support, extension services, irrigation and other supports. The production of feed grains and tubers, which are important raw materials for feed industries, has not been given the same level of assistance. Until 1997, BULOG controlled the trade of corn, soybean, soybean cake and fishmeal, most of which is imported. Domestic markets for these feedstuffs were controlled through market intervention to satisfy both producers and consumers by stabilizing their prices.

Corn

Corn is considered the most important feed ingredient in poultry rations and constitutes around 50-60 percent of the rations. It can be produced in almost all provinces of Indonesia. The domestic resource-cost ratios in most provinces are less than one, indicating its comparative advantage. In general, corn yield in Java is higher than in other parts of the country and the increase in production is mainly associated with the increase in yield. In the late 1990s, Indonesia was importing and exporting corn, but on the whole it is a net importing country. Indonesia became a corn importing country for the first time in 1976 with imports of 68 773 t and these increased to 169 398 t in 1987. Corn exports fluctuate with the season and occur at the harvest time when the domestic price falls. Exports began in 1970 when 282 196 t was exported, but had decreased to only 50 723 t by 1975.

Most domestic corn is for human consumption, but the share is decreasing (70 percent in 1970 and 56 percent in 1986). The share of corn in livestock feed has increased from 15 percent in 1970 to 44 percent in 1985, and industrial use has been steady at 3.4 percent in 1970 and 3.6 percent in 1986. Before 1980, the food balance sheets (FBS) estimated 2 percent of corn went to livestock feeds, but the estimate was later adjusted upward to 6 percent. In 1995 it was estimated that 547 000 t of corn, or about 6 percent of the domestic supply of 9 113 000 t, was used in livestock feeds. According to the Directorate General of Livestock Services (DGLS) in 1996 Indonesia's 60 largest feed mills used 3 551 190 t, six times the estimate of the FBS, while actual use by these same large feed mills was 40 percent of availability in 1995.

Soybean

Another important feed ingredient is soybean, used as a protein source. Central Java is the largest soybean producing region of Indonesia, while Sumatra and Sulawesi are the most important regions outside Java. Indonesia has imported soybean since 1975 in the form of grain, soybean cake and soybean flour. Soybean production is not economically feasible, as indicated by the domestic resource-cost ratio of greater than 1.0. Soybean is imported from countries such as USA, China, and Brazil, because the local soybean production of around 1.5 million tonnes is not sufficient to satisfy domestic demand both for livestock feed and human consumption. Soybean imports have been increasing at the rate of about 9 percent per year.

For soybeans, the FBS approach derived the 1995 consumption estimate by adding domestic production of 1 689 000 t to imports of 607 000 t, plus stock changes. Imports of soybean cake for livestock feed were almost equal in value to imports of the beans (US\$194 million of cake versus US\$216 million of beans in 1996).

Drugs and vaccines

The number of veterinary medicine producers, distributors, wholesalers and special shops increased from 1 300 in 1991 to 1 500 in 1995. The shops sell a variety of animal production requisites including vaccines, pharmaceuticals, premixes and other types of biological products. Biological products in the form of vaccines for poultry which are locally produced increased from 929 million doses in 1991 to 1 564 million doses in 1995, while imported products rose from 1 029 million doses, overall (1991), to 2 679 million doses (1995). Imported vaccines for ruminants (small and large) represent a smaller portion of the total available biological products. They numbered 88 000 doses in 1991 and 76 300 doses in 1995. The total value of imported veterinary medicines increased slightly from Rp. 100 739 million in 1991 to Rp. 131 690 million 1995, while the value of domestic products amounted to Rp. 159 656 million in 1991 and rose to Rp. 233 200 million in 1995. The increased value of domestic veterinary medicines reflects the government objective of reducing Indonesia's dependence on veterinary medicines supplied by foreign sources.

CONCLUDING COMMENTS

International trade in livestock products in the free trade era means that strong competition will have to be faced in the future. While the livestock trade in Indonesia is important to meet the increasing demand for meat, milk, and eggs, the present distribution within the country is more important. Production centres are generally concentrated in the village areas, while consumers are in the urban areas.

Domestic production has initially satisfied the national demand for meat, but the industry faces competition from the cattle-producing countries that have entered the domestic market. It is apparent that Indonesia, in its effort to develop livestock production for domestic consumption, has to take international trade in livestock and livestock products into consideration when deciding where its comparative advantage lies.

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APPENDIX: THE INDONESIAN FEED AND LIVESTOCK SECTOR. A STATISTICAL OVERVIEW

Paul Riethmuller

Department of Economics, University of Queensland, Brisbane, Australia

The purpose of this part of the report is to outline the characteristics of the Indonesian feed and livestock sector, focusing on developments between 1985 and 1997. The livestock industries cover the poultry industries, the dairy industry, beef and pig meats, as well as smaller industries such as sheep, horses and goats. A number of these industries are regionally concentrated - the dairy industry for example is to be found in the highland areas of Java - and a number have expanded rapidly over recent years as income levels in Indonesia have grown. The future of industries such as the beef and dairy industries must now be very uncertain in light of the financial difficulties that arose in Indonesia in the latter half of 1997. The uncertainty is due to the sharply reduced rates of economic growth that can be expected for the next few years and the IMF imposed restrictions on government support for industry.

This section of the report begins by describing some of the broad characteristics of the Indonesian economy. This includes details of growth rates of population and income. This information is important because one of the reasons for the expansion in livestock industries is the income growth that led analysts to classify Indonesia as one of the tiger economies of Asia. Yet because of Indonesia's limited land area, it seems to be not well suited to industries based upon large livestock. A broad overview of the livestock industries follows, including some information on the characteristics of the people working in the industry. Then comes an outline of each of the industries, with details being provided on livestock numbers, production and the regional distribution of livestock. The feed stuff industry is described next, and this is followed by information on the consumption of livestock products, including elasticity estimates obtained from econometric studies.

SOME FEATURES OF THE INDONESIAN ECONOMY

In February 1997, the population of Indonesia passed 200 million people. This made it the world's fourth most populous country. There has been a slowing of the population growth rate. It was 2.32 percent between 1971 (when Indonesia's population was 119 million people) and 1980, while for the period from 1990 (when there were 179 million Indonesians) to 1995, the growth rate was 1.66 percent per year. Over 100 million people live on Java, an island with an area of about 132 000 km². Indonesia's overall land area is 1 919 317 km² and there are over 13 000 islands making up the Indonesian archipelago. Perhaps about half of these islands are uninhabited. Indonesia is divided into 28 provinces, which vary greatly in such characteristics as population, income level, rate of economic development and industry structure. That the provinces are diverse should not be surprising. Indonesia stretches more than 5 000 km from east to west and more than 1 800 km from north to south. It is a tropical country, lying on the equator and extending from 94°E to 141°E longitude

Levine (1982) classifies Indonesia into inner islands (Java, Bali and Madura) and the outer islands (Sumatra, Kalimantan, Sulawesi, and others). The inner islands are the ones that are more heavily populated and contain a high proportion of Indonesia's best soil, which is volcanic. Much of the soil on the outer islands is poor quality podzolic soil. Its land is suitable for tropical and sub-tropical crops and for lowland and upland crops.

The island of Jawa (Java) has three provinces - Jawa Timur (East Java), Jawa Barat (West Java) and Jawa Tengah (Central Java). It also has the autonomous regency of Yogyakarta and the administrative region of the capital, Jakarta. Java's land area represents approximately 10 percent of Indonesia's area. About 60 percent of Indonesia's population live in Java, resulting in a very high population density of 814 people per km² in 1990 and 868 per km² in 1995. Despite this high population density, Java is where much of the livestock industry is to be found. Proximity to the consumers is perhaps the main reason. Kalimantan makes up around 28 percent of Indonesia's land area, making it the largest of Indonesia's islands. It has one of the lowest population densities and is relatively undeveloped (Table 1).

Table 1. Percentage of population and density per km² by province, 1971 to 1995

Province	Percentage of total population				Population density per km ²			
	1971	1980	1990	1995	1971	1980	1990	1995
	(%)	(%)	(%)	(%)	(km ⁻²)	(km ⁻²)	(km ⁻²)	(km ⁻²)
DI Aceh	1.68	1.77	1.90	1.98	36	47	62	69
Sumatera Utara	5.55	5.67	5.72	5.71	93	118	145	157
Sumatera Barat	2.34	2.31	2.23	2.22	56	68	80	87
Riau	1.38	1.47	1.84	2.00	17	23	35	41
Jambi	0.84	0.98	1.13	1.22	22	32	45	53
Sumatera Selatan	2.89	3.14	3.52	3.70	33	45	61	70
Bengkulu	0.44	0.52	0.66	0.72	24	36	56	66
Lampung	2.33	3.14	3.35	3.42	83	139	181	200
Sumatera	17.45	19.00	20.35	20.96	44	59	77	86
DKI Jakarta	3.84	4.41	4.60	4.68	7 762	11 023	12 495	15 445
Jawa Barat	18.14	18.61	19.73	20.13	467	593	765	847
Jawa Tengah	18.35	17.20	15.90	15.23	640	742	834	867
DI Yogyakarta	2.09	1.87	1.62	1.50	785	868	919	920
Jawa Timur	21.41	19.79	18.12	17.38	532	609	678	706
Jawa	63.83	61.88	59.97	58.91	576	690	814	868
Bali	1.78	1.67	1.55	1.49	381	444	500	521
Nusa Tenggara Barat	1.85	1.85	1.88	1.87	109	135	167	181
Nusa Tenggara Timur	1.93	1.86	1.82	1.84	58	57	68	75
Timor-Timur		0.38	0.42	0.43		37	50	56
Nusa Tenggara	5.56	5.76	5.67	5.63	75	96	115	124
Kalimantan Barat	1.69	1.69	1.80	1.87	14	17	22	25
Kalimantan Tengah	0.59	0.65	0.78	0.84	5	6	9	11
Kalimantan Selatan	1.43	1.40	1.45	1.49	45	55	69	77
Kalimantan Timur	0.62	0.83	1.05	1.19	4	6	9	11
Kalimantan	4.33	4.56	5.08	5.38	10	12	17	19
Sulawesi Utara	1.44	1.43	1.38	1.36	90	111	130	139
Sulawesi Tengah	0.77	0.87	0.95	1.00	13	18	25	28
Sulawesi Selatan	4.35	4.11	3.89	3.88	71	83	90	104
Sulawesi Tenggara	0.60	0.64	0.75	0.81	26	34	49	57
Sulawesi	7.16	7.05	6.97	7.05	45	55	66	73
Maluku	0.91	0.96	1.04	1.07	15	19	25	28
Irian Jaya	0.77	0.80	0.92	1.00	2	3	4	5
Maluku & Irian Jaya	1.68	1.76	1.96	2.07	4	5	7	8
Indonesia	100.00	100.00	100.00	100.00	62	77	93	101

Source: Direktorat Jenderal Peternakan (1996), p.126 for 1971 to 1990 data; Biro Pusat Statistik (1996), p.35.

Agriculture, forestry, hunting and fisheries provided employment to just over 35 million of the 80 million economically active Indonesians in 1995. As shown in Figure 1, the share of agriculture in GDP was more than 50 percent in the early 1970s, but it had fallen to about 16 percent in 1995 (Biro Pusat Statistik, 1996).

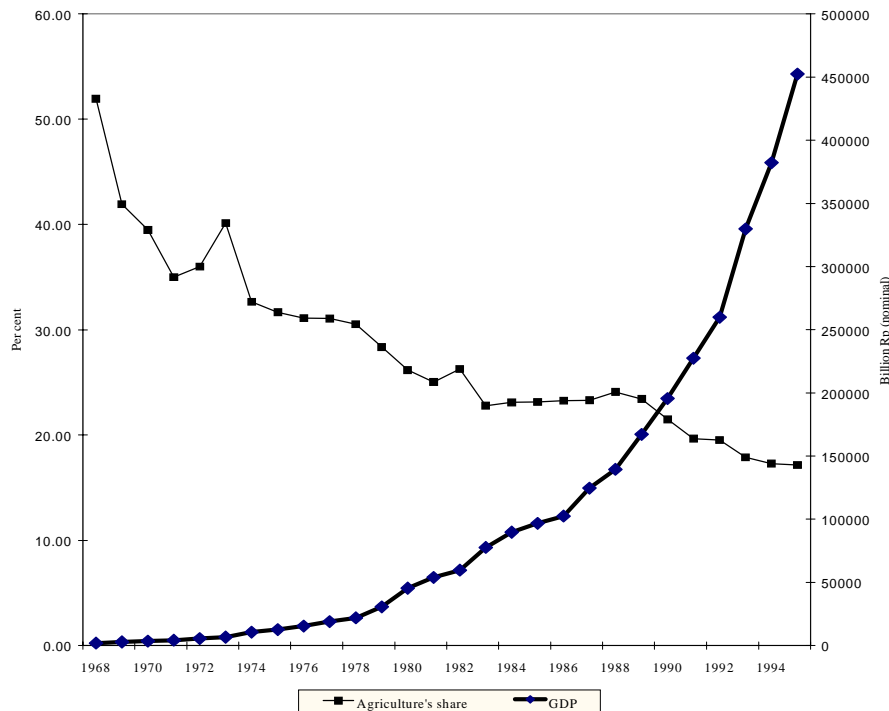


Figure 1. Nominal GDP and agriculture's share of GDP

The key agricultural commodity is rice. Self-sufficiency in rice was achieved in 1984 due to the government providing farmers with high quality seeds, fertilizer and insecticides. Rice self-sufficiency has been maintained since then although there are doubts that this will be the case in the future. El Niño-induced dryness and a loss in plant production due to the forest fires are reasons for this uncertainty. Other important agricultural industries are cassava, rubber, tea and palm oil. The role of livestock has been increasing and the development of the livestock industries has been a major priority for the government after rice self-sufficiency. Over the last decade, livestock has made up between 10 percent and 11 percent of agriculture, and around 2 percent of GDP (Figure 2).

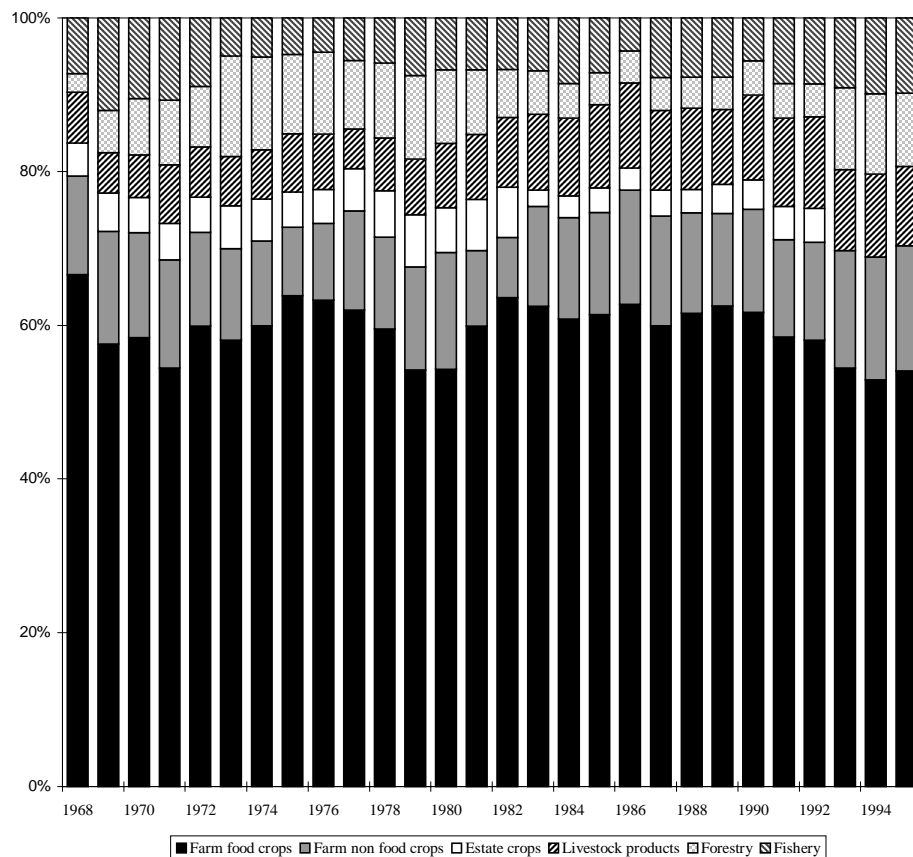


Figure 2. Contribution of agricultural industries to total agricultural output

Per person income in Indonesia is below US\$1 000 per person. In recent years, the middle class has been expanding (albeit from a small base) as the growth of the economy has created many business and employment opportunities. According to Kasryo and Suryana (1992), rural poverty decreased from 44.2 million in 1976 to 17.8 million in 1990. Similarly, income inequality as measured by the Gini coefficient has declined. The index fell from 0.343 in 1978 to 0.25 in 1990 for all households, while for rural households the coefficient dropped from 0.38 to 0.34 over the same period (Kasryo and Suryana 1992). Nonetheless, there are still many very poor people, particularly in rural areas. These numbers have increased along with increasing unemployment due to the decline in Indonesia's economic growth. As will be explained later in more detail, some of the livestock programmes the government has introduced have had the objective of improving the income position of the very poor. There were about 19 million farm households in Indonesia in 1983 with control of land. The area most households controlled was small, averaging less than 0.5 ha. Moreover, 2.3 million households had under 0.1 ha, and a further 7 million had between 0.1 ha and 0.49 ha. About 11 million of the 19 million farm households were on Java (Table 2).

Table 2. Number of farm households and area of land under a household's control, 1983

Province	under 0.05 ha	0.05-0.09 ha	0.10-0.24 ha	0.25-0.49 ha	0.50 ha & above	Total
	(000)	(000)	(000)	(000)	(000)	(000)
DI Aceh	8.8	12.2	39.3	71.1	265.2	396.6
Sumatera Utara	51.5	46.5	134.3	170.3	603.6	1 006.2
Sumatera Barat	17.4	19.0	57.0	107.0	305.6	506.0
Riau	13.0	7.4	12.1	19.4	323.0	283.9
Jambi	7.7	5.6	11.4	19.1	188.4	232.2
Sumatera Selatan	13.7	10.1	19.2	47.1	478.2	568.3
Bengkuku	2.3	1.5	3.5	10.3	116.7	134.3
Lampung	9.6	11.5	28.3	100.6	574.2	724.2
DKI Jakarta	9.3	5.2	3.8	1.7	3.1	23.1
Jawa Barat	327.7	358.4	841.3	809.4	1 214.5	3 551.3
Jawa Tengah	282.3	251.8	748.8	930.8	1 375.5	3 589.2
DI Yogyakarta	30.8	44.1	103.0	89.4	161.8	3 976.3
Jawa Timur	326.7	269.2	845.1	1 024.1	1 511.0	429.1
Bali	17.6	14.7	45.8	81.2	187.2	346.5
Nusa Tenggara Barat	28.8	17.8	59.6	81.6	209.9	397.7
Nusa Tenggara Timur	8.4	9.0	19.7	42.6	377.1	456.8
Timor-Timur	5.6	4.2	4.6	6.4	93.2	114.0
Kalimantan Barat	6.2	4.3	10.0	24.0	348.6	393.1
Kalimantan Tengah	2.4	2.1	3.4	5.5	137.6	151.0
Kalimantan Selatan	11.0	9.3	32.1	66.0	201.0	319.4
Kalimantan Timur	5.8	3.9	4.8	8.4	92.6	115.5
Sulawesi Utara	11.5	8.3	23.9	39.0	206.9	289.6
Sulawesi Tengah	5.2	3.4	5.8	14.8	178.7	207.9
Sulawesi Selatan	40.3	24.3	64.9	122.3	548.8	800.6
Sulawesi Tenggara	5.1	3.7	6.1	14.3	119.7	148.9
Maluku	5.8	5.1	8.9	12.3	158.9	191.0
Irian Jaya	16.5	14.9	19.2	24.4	87.7	162.7
Total	1 271.0	1 167.5	3 155.9	3 943.3	9 977.7	19 515.4

Source: Direktorat Jenderal Peternakan (1986), p.137.

Table 3. Number of farm and livestock households, 1983 and 1993

Province	Farm households (A)		Livestock households (B)		B/A	
	1983	1993	1983	1993	1983 (%)	1993 (%)
DI Aceh	396 000	523 000	112 527	157 000	28.4	30.0
Sumatera Utara	1 006 000	1 118 000	184 081	245 000	18.3	21.9
Sumatera Barat	506 000	539 000	97 357	119 000	19.2	22.1
Riau	284 000	403 000	38 130	73 000	13.4	18.1
Jambi	232 000	295 000	41 002	48 000	17.7	16.3
Sumatera Selatan	568 000	838 000	80 297	128 000	14.1	15.3
Bengkulu	134 000	190 000	23 493	28 000	17.5	14.7
Lampung	724 000	974 000	92 459	199 000	12.8	20.4
DKI Jakarta	23 000	13 000	3 656	1 000	15.9	7.7
Jawa Barat	3 551 000	3 541 000	435 251	487 000	12.3	13.8
Jawa Tengah	3 589 000	3 606 000	723 478	906 000	20.2	25.1
DI Yogyakarta	429 000	433 000	101 189	153 000	23.6	35.3
Jawa Timur	3 976 000	4 245 000	1 282 434	1 526 000	32.3	35.9
Bali	346 000	351 000	165 532	205 000	47.8	58.4
Nusa Tenggara Barat	397 000	454 000	141 426	169 000	35.6	37.2
Nusa Tenggara Timur	457 000	551 000	187 384	249 000	41.0	45.2
Timor-Timur	114 000	131 000	32 664	60 000	28.7	45.8
Kalimantan Barat	382 000	491 000	99 958	144 000	26.2	29.3
Kalimantan Tengah	151 000	224 000	22 730	30 000	15.1	13.4
Kalimantan Selatan	320 000	366 000	37 231	59 000	11.6	16.1
Kalimantan Timur	115 000	182 000	23 399	37 000	20.3	20.4
Sulawesi Utara	290 000	349 000	75 699	91 000	26.1	26.1
Sulawesi Tengah	208 000	260 000	56 841	68 000	27.3	26.1
Sulawesi Selatan	800 000	935 000	315 046	310 000	39.4	33.2
Sulawesi Tenggara	149 000	200 000	23 248	42 000	15.6	21
Maluku	191 000	266 000	22 826	43 000	12.0	16.2
Irian Jaya	163 000	258 000	64 025	106 000	32.3	41.1
Indonesia	19 501 000	21 736 000	4 483 363	5 683 000	23.0	26.1

Source: Direktorat Jenderal Peternakan (1996), p.49.

Farm household numbers actually increased between 1983 and 1993 from 19.5 million to 21.7 million (Table 3). The proportion of farm households with livestock also increased between 1983 and 1993. For the country as a whole, just over 26 percent of farm households in 1993 had livestock, whereas in 1983, just on 23 percent of households had livestock. The provinces where the greatest proportion of households had livestock in 1993 were Bali (58 percent), Nusa Tenggara Timur (45 percent), Timor-Timur (45.8 percent), Irian Jaya (41 percent) and Nusa Tenggara Barat (37.2 percent). These provinces also had a high proportion of farm households with livestock in 1983.

AGRICULTURE IN THE REGIONS

As shown above in Figure 1, the importance of agriculture to Indonesia's economy has been declining, although when data on a regional basis are examined, it becomes apparent that the decline has been far from even. The provinces contributing most to Indonesia's agricultural output are the three Javanese provinces of Jawa Timur, Jawa Barat and Jawa Tengah. In 1991, they contributed about 50.72 percent of Indonesia's agricultural output, while in 1995, their contribution was 44.3 percent. Sumatera Utara, Sulawesi Selatan and Sumatera Selatan were the next most important with a combined contribution of 17 percent and 17.94 percent in 1991 and 1995, respectively. Timor-Timur, Bengkulu and Sulawesi Tenggara made the smallest contributions to agricultural GDP in each of 1991 and 1995 (Table 4).

Table 4. Agricultural GDP in current prices, by region (billion rupiah)

Provinces	1991	1992	1993	1994	1995
DI Aceh	1 470.9	1 813.1	1 906.2	2 385.5	2 987.5
Sumatera Utara	4 141.9	4 995.0	4 895.7	5 494.8	6 165.5
Sumatera Barat	1 162.5	1 271.4	1 313.1	1 545.0	1 725.6
Riau	839.1	929.8	1 252.1	1 378.0	1 574.1
Jambi	535.9	604.4	708.7	833.9	973.0
Sumatera Selatan	1 582.0	1 772.2	2 015.3	2 450.7	3 242.9
Bengkulu	357.8	411.5	464.0	648.4	773.4
Lampung	1 462.1	1 771.2	1 993.7	2 460.6	3 178.2
DKI Jakarta	232.5	197.6	144.4	141.1	151.0
Jawa Barat	7 826.2	8 745.2	9 107.8	10 344.5	11 453.0
Jawa Tengah	7 572.2	8 498.4	7 810.6	8 778.9	10 414.5
DI Yogyakarta	597.0	675.6	699.9	855.8	945.4
Jawa Timur	8 368.4	9 381.8	9 670.0	10 302.4	11 336.1
Bali	1 166.7	1 253.1	1 253.8	1 357.3	1 485.6
Nusa Tenggara Barat	748.1	856.6	974.3	1 152.9	1 325.1
Nusa Tenggara Timur	681.4	768.5	858.0	998.2	1 143.8
Timor-Timur	130.6	149.0	153.6	186.8	208.7
Kalimantan Barat	877.1	957.9	1 291.0	1 491.2	1 768.0
Kalimantan Tengah	562.3	652.8	1 126.8	1 469.9	1 771.3
Kalimantan Selatan	697.1	838.9	1 123.1	1 250.8	1 444.0
Kalimantan Timur	1 066.8	1 141.6	1 677.7	1 820.8	2 066.3
Sulawesi Utara	630.9	717.2	775.1	877.1	1036.2
Sulawesi Tengah	473.3	528.3	646.9	821.4	1020.3
Sulawesi Selatan	2 239.5	2 639.0	2 865.6	3 354.2	4 028.9
Sulawesi Tenggara	391.8	402.8	434.8	510.3	608.2
Maluku	590.1	645.2	728.1	826.7	840.4
Irian Jaya	456.1	492.1	973.2	1 114.8	1 284.2
Indonesia	46 860.2	53 110.4	56 863.6	64 852.2	74 950.9

Notes: 1994 are preliminary figures, 1995 are very preliminary

Source: Direktorat Jenderal Peternakan (1997), p.7.

To see which provinces were most heavily dependent upon agriculture, the percentage of each region's GDP attributable to agriculture was calculated for each of the years 1991 to 1995. The share of agriculture for each of these years in each of the provinces is shown in Table 5

while Figure 3 presents this information for 1991 and 1995. In 1995, Kalimantan Tengah was the province most heavily dependent upon agriculture since almost 41 percent of GDP came from agriculture. In 1991, it was ranked 10 in terms of its dependence upon agriculture. Nusa Tenggara Timur was the region most heavily dependent upon agriculture in that year. The agricultural sectors of DKI Jakarta, Riau and Kalimantan Timur represented less than 10 percent of GDP in each of these regions, making them the least dependent upon agriculture.

Table 5. The share of agriculture in regional GDP

Province	1991	1992	1993	1994	1995
	(%)	(%)	(%)	(%)	(%)
DI Aceh	18.46	21.02	17.51	21.22	23.28
Sumatera Utara	34.20	34.89	26.88	25.35	24.98
Sumatera Barat	31.03	29.73	21.79	21.41	21.27
Riau	5.56	6.34	7.26	7.56	7.39
Jambi	33.97	33.81	28.77	28.65	28.18
Sumatera Selatan	17.58	17.67	18.77	20.32	22.26
Bengkulu	37.99	37.39	33.34	36.18	37.03
Lampung	40.01	40.71	36.85	37.66	39.62
DKI Jakarta	0.88	0.64	0.28	0.24	0.22
Jawa Barat	21.38	21.30	17.29	16.58	15.62
Jawa Tengah	29.15	28.14	22.99	22.34	22.64
DI Yogyakarta	27.13	27.02	17.25	17.53	16.83
Jawa Timur	24.56	24.33	19.67	18.03	17.12
Bali	33.31	31.52	22.04	20.91	20.05
Nusa Tenggara Barat	47.58	45.80	38.20	38.94	38.23
Nusa Tenggara Timur	48.79	46.89	40.92	40.64	39.71
Timor-Timur	39.84	38.55	29.80	30.95	29.45
Kalimantan Barat	27.12	25.87	25.08	24.65	24.77
Kalimantan Tengah	34.67	33.45	36.74	40.19	40.70
Kalimantan Selatan	25.67	26.50	24.63	23.63	23.52
Kalimantan Timur	8.72	8.46	10.47	9.50	9.49
Sulawesi Utara	36.43	36.54	27.62	27.49	27.32
Sulawesi Tengah	42.68	41.68	36.85	38.85	39.86
Sulawesi Selatan	42.56	43.47	38.15	38.39	39.14
Sulawesi Tenggara	40.55	37.86	33.73	33.79	33.42
Maluku	33.71	33.24	29.68	29.66	27.08
Irian Jaya	16.91	16.09	20.51	20.76	18.31
Indonesia	21.36	21.42	17.57	17.31	17.09

Notes: 1994 are preliminary figures, 1995 are very preliminary

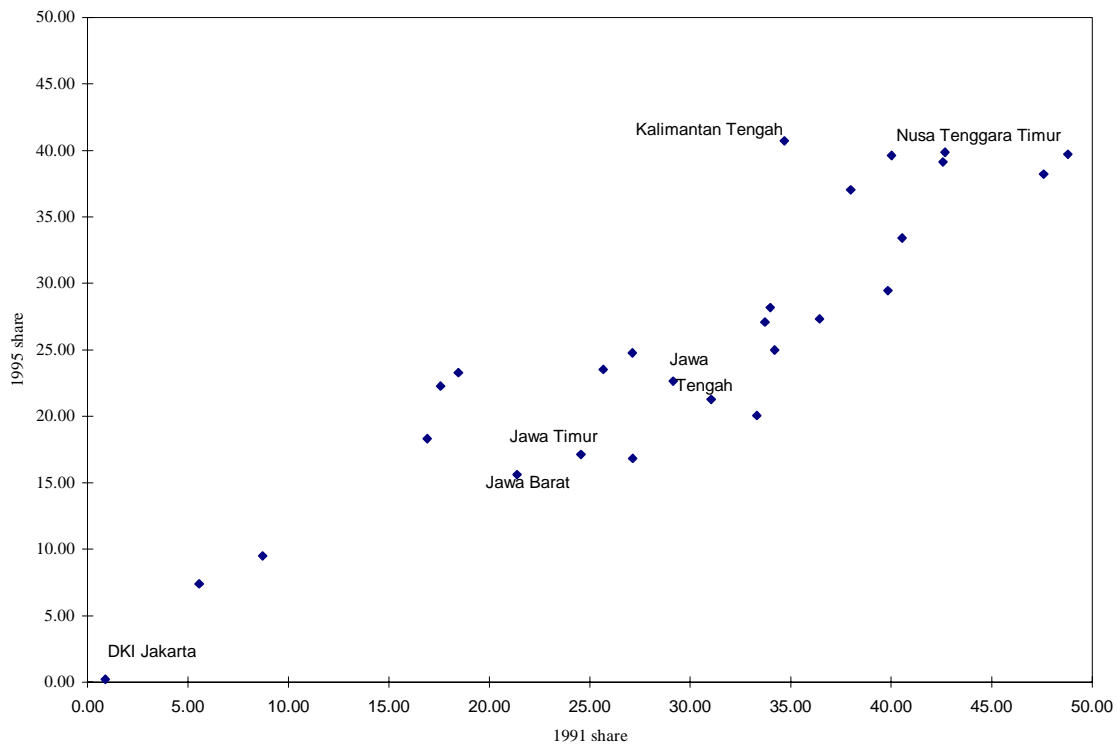


Figure 3. Agriculture's share of regional GDP, 1991 and 1995

THE IMPORTANCE OF LIVESTOCK TO THE REGIONAL ECONOMY

The livestock industries are concentrated on Java island. The three provinces of Jawa Tengah, Jawa Timur and Jawa Barat accounted for about 15.9 percent, 16.3 percent and 18 percent, respectively, of livestock production in Indonesia in 1995. This made these three the major livestock provinces. In 1991, they were also the main livestock producing provinces, although their relative positions were different. Then Jawa Timur with 17.9 percent of Indonesia's livestock production was the most important, followed by Jawa Tengah (16.8 percent) and Jawa Barat (11.61 percent). The other 24 provinces accounted only for around 50 percent of livestock output. Kalimantan Selatan, Maluku, Timor-Timur and Irian Jaya each had less than 0.5 percent of Indonesia's livestock output in 1991. For Timor-Timur and Maluku the situation was similar in 1995, with the contribution of each still being less than half a percent. Tables 6 and 7 show the livestock GDP in each of the 27 provinces during 1991-1995 while Figures 4 and 5 show each province's share of Indonesia's livestock GDP in 1991 and in 1995. Although there have been some changes in the relative importance of the provinces, there was a high correlation between the contribution of each province in 1991 and in 1995 to Indonesia's livestock production.

Table 6. Regional GDP of livestock at current prices (million rupiah)

Provinces	1991	1992	1993	1994	1995
DI Aceh	134 937	169 429	242 189	323 065	455 150
Sumatera Utara	445 135	608 170	498 830	586 754	682 102
Sumatera Barat	86 790	103 191	155 795	167 355	191 373
Riau	46 777	55 410	59 556	73 963	93 448
Jambi	79 317	85 857	73 936	89 720	100 433
Sumatera Selatan	107 402	123 803	176 989	212 351	242 805
Bengkulu	43 791	49 798	56 933	64 205	74 953
Lampung	210 872	253 990	331 319	386 841	453 939
DKI Jakarta	108 909	91 702	14 499	14 921	12 312
Jawa Barat	555 801	978 191	1 172 930	1 361 526	1 591 967
Jawa Tengah	805 654	989 819	1 062 481	1 208 380	1 409 655
DI Yogyakarta	105 486	123 047	111 183	130 958	142 970
Jawa Timur	857 971	959 888	900 665	1 148 773	1 446 605
Bali	298 029	334 035	306 237	337 104	366 967
Nusa Tenggara Barat	103 516	122 881	128 116	144 210	163 200
Nusa Tenggara Timur	151 541	176 387	201 784	259 533	298 184
Timor-Timur	17 536	21 651	19 791	20 299	22 024
Kalimantan Barat	89 679	99 095	128 531	140 474	169 067
Kalimantan Tengah	28 745	171 135	39 385	51 234	62 976
Kalimantan Selatan	9 794	60 594	62 765	80 695	90 598
Kalimantan Timur	78 812	99 305	110 468	160 262	205 576
Sulawesi Utara	55 148	60 624	58 749	69 020	86 532
Sulawesi Tengah	43 231	60 826	78 980	107 915	131 955
Sulawesi Selatan	230 924	271 204	126 108	137 304	136 119
Sulawesi Tenggara	50 230	41 314	49 092	63 113	97 301
Maluku	15 662	198 180	20 492	24 577	31 355
Irian Jaya	23 679	25 603	67 932	79 057	91 361
Indonesia	5 126 200	6 040 700	6 202 700	7 102 300	7 998 500

Notes: 1994 are preliminary figures, 1995 are very preliminary

Source: Direktorat Jenderal Peternakan (1997), p.5.

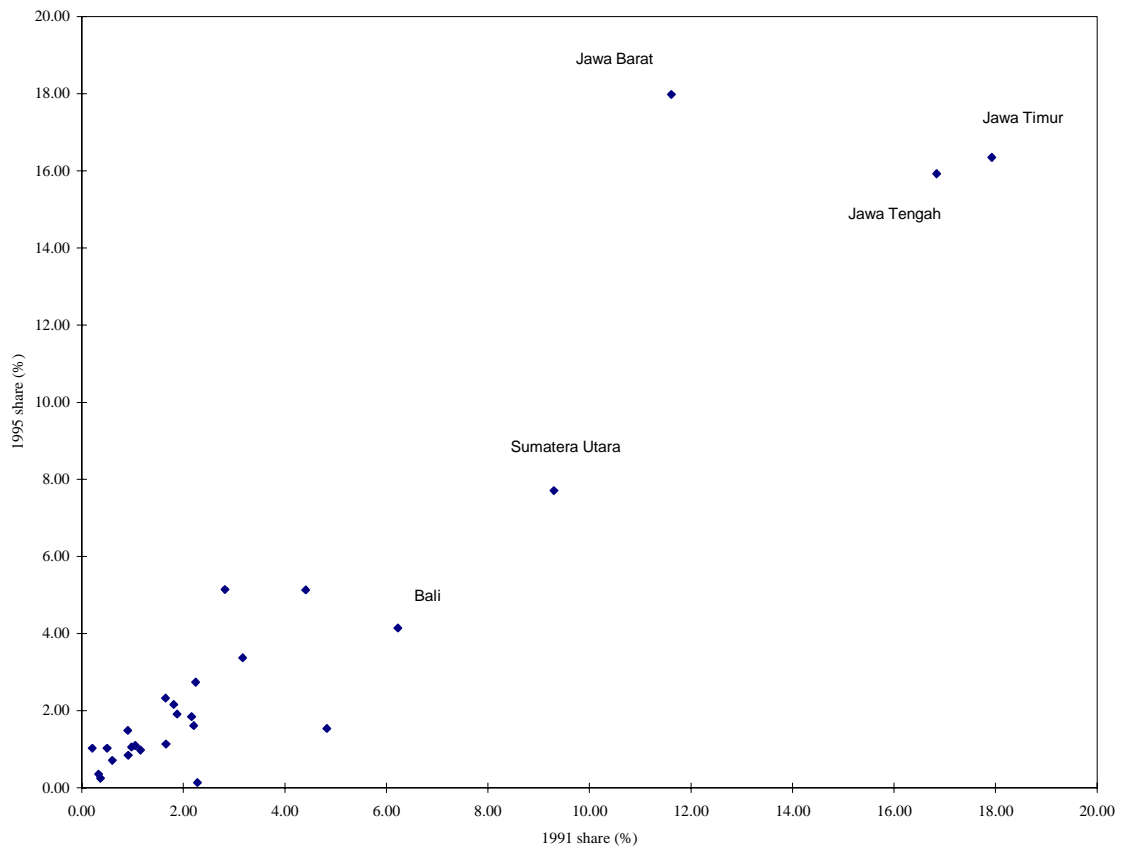


Figure 4. The contribution of regions to Indonesia's livestock production, 1991 and 1995

Table 7. The contribution of the livestock industries to regional GDP

Provinces	1991	1992	1993	1994	1995
	(%)	(%)	(%)	(%)	(%)
DI Aceh	1.69	1.96	2.23	2.87	3.55
Sumatera Utara	3.68	4.25	2.74	2.71	2.76
Sumatera Barat	2.32	2.41	2.58	2.32	2.36
Riau	0.31	0.38	0.35	0.41	0.44
Jambi	5.03	4.80	3.00	3.08	2.91
Sumatera Selatan	1.19	1.23	1.65	1.76	1.67
Bengkulu	4.65	4.53	4.09	3.58	3.59
Lampung	5.77	5.84	6.12	5.92	5.66
DKI Jakarta	0.41	0.30	0.03	0.03	0.02
Jawa Barat	1.52	2.38	2.23	2.18	2.17
Jawa Tengah	3.10	3.28	3.13	3.07	3.06
DI Yogyakarta	4.79	4.92	2.74	2.68	2.54
Jawa Timur	2.52	2.49	1.83	2.01	2.18
Bali	8.51	8.40	5.38	5.19	4.95
Nusa Tenggara Barat	6.58	6.57	5.02	4.87	4.71
Nusa Tenggara Timur	10.85	10.76	9.62	10.57	10.35
Timor-Timur	5.35	5.60	3.84	3.36	3.11
Kalimantan Barat	2.77	2.68	2.50	2.32	2.37
Kalimantan Tengah	1.77	8.77	1.28	1.40	1.45
Kalimantan Selatan	0.36	1.91	1.38	1.52	1.48
Kalimantan Timur	0.64	0.74	0.69	0.84	0.94
Sulawesi Utara	3.18	3.09	2.09	2.16	2.28
Sulawesi Tengah	3.90	4.80	4.50	5.10	5.16
Sulawesi Selatan	4.39	4.47	1.68	1.57	1.32
Sulawesi Tenggara	5.20	3.88	3.81	4.18	5.35
Maluku	0.89	10.21	0.84	0.88	1.01
Irian Jaya	0.88	0.84	1.43	1.47	1.30
Indonesia	2.34	2.44	1.92	1.90	1.82

Notes: 1994 are preliminary figures, 1995 are very preliminary

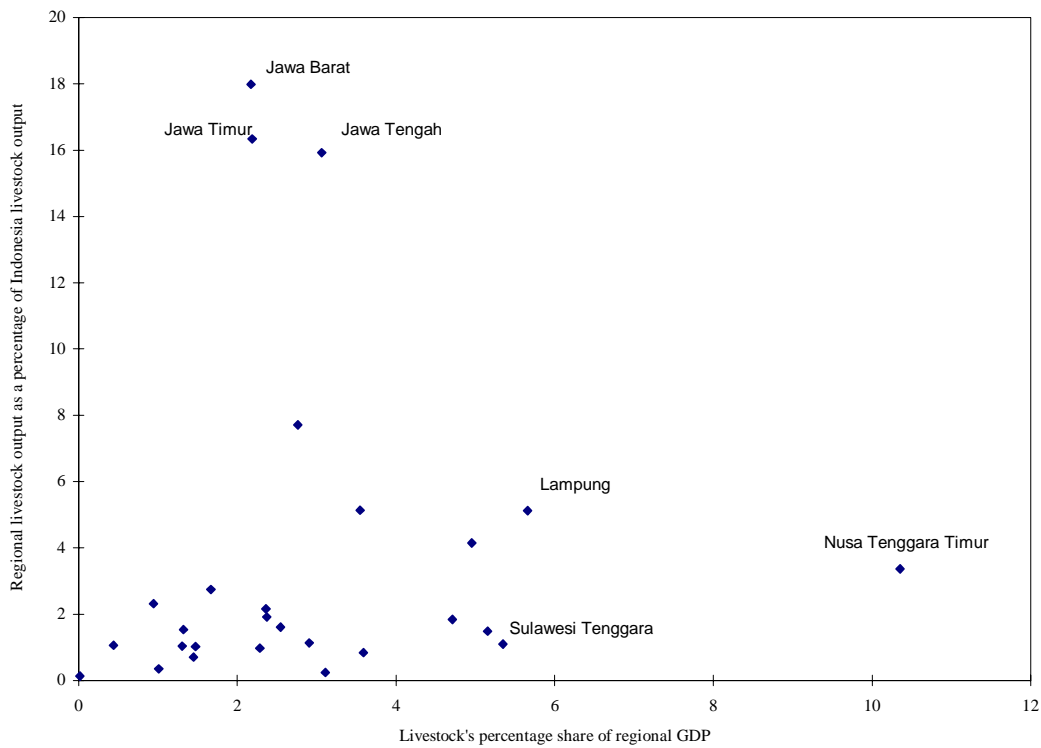


Figure 5. The relationship between the importance of the regions to Indonesia's livestock output and the importance of livestock to each region's GDP, 1995

CHARACTERISTICS OF THE LIVESTOCK INDUSTRY

Indonesia had about 11 million beef cattle in 1995, and almost 12 million goats. Dairy cattle numbered approximately 330 000. Over the period 1941 to 1997, and perhaps somewhat surprisingly for a Moslem country, the number of pigs increased by a factor of seven from 1 296 000 to over 9 000 000 (Figure 6).

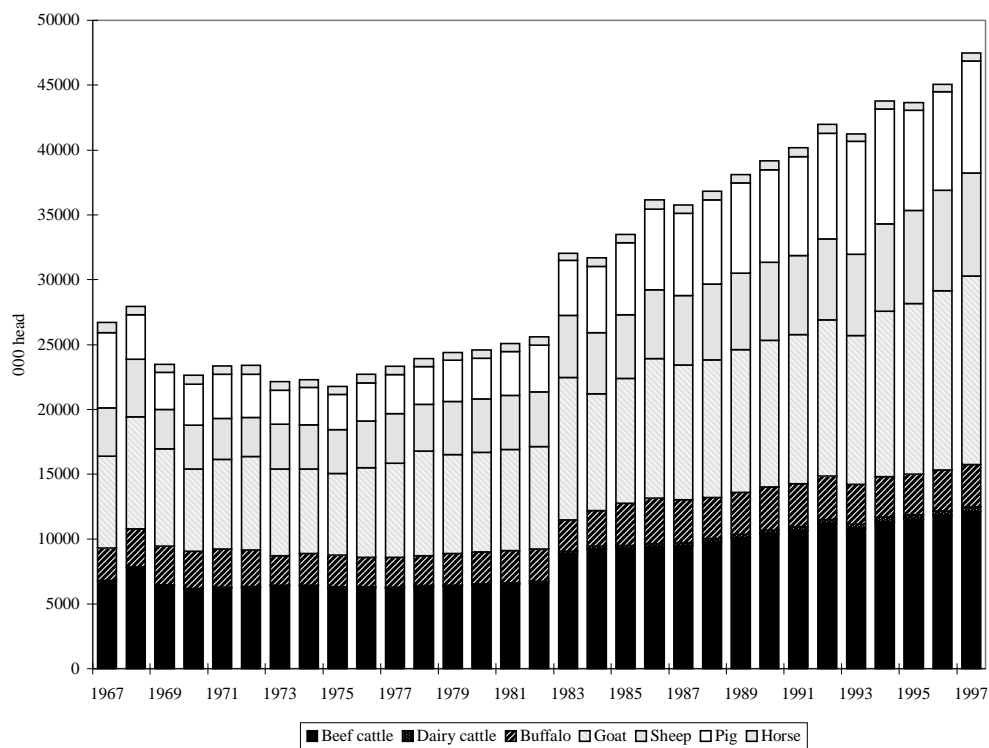


Figure 6. Number of four footed animals, 1967 to 1997

The Indonesian government began to seriously pursue food self-sufficiency in 1964 (Soewardi and Atmadilaga 1982), and as noted already self-sufficiency in rice was achieved in the early 1980s. Improved practices developed at Bogor Agricultural University increased rice yields dramatically and led to the adoption of the *Bimas* or mass guidance programme. A similar programme was tried for livestock - the “*Bimas* of Livestock”. When first set up, this programme focused on egg production and the fattening of beef cattle (Soewardi and Atmadilaga 1982). Indonesia has attempted to achieve its economic objectives through a series of five-year development plans as well as longer term (25 year) plans that overlap with the five-year plans. The timing of these and the livestock production associated with each are shown in Table 8.

Table 8. Meat, egg and milk production, 1969 to 1994

Five-year Plan	Year	Meat (kt)	Egg (kt)	Milk (kt)
Repeleta I	1969	309.3	57.7	28.9
	1970	313.6	58.6	29.3
	1971	332.2	68.4	35.8
	1972	366.2	77.5	37.7
	1973	379.4	81.4	35.0
Repeleta II	1974	403.1	98.1	56.9
	1975	435.0	112.2	51.1
	1976	448.9	115.6	58.0
	1977	467.7	131.4	60.7
	1978	474.6	151.0	62.3
Repeleta III	1979	486.5	164.5	72.2
	1980	571.3	262.6	78.4
	1981	596.0	275.2	85.8
	1982	628.5	297.0	117.6
	1983	651.5	316.0	174.6
Repeleta IV	1984	742.2	355.3	179.0
	1985	808.9	369.9	191.9
	1986	879.0	437.2	220.2
	1987	895.5	451.5	234.9
	1988	937.0	443.1	264.9
Repeleta V	1989	971.1	456.2	338.2
	1990	1027.7	484.0	345.6
	1991	1099.2	510.4	360.2
	1992	1239.2	572.3	367.2
	1993	1378.3	572.9	387.5
Repeleta VI	1994	1492.9	668.6	426.7
	1995 ^(a)	1564.3	728.8	432.9

Notes: ^(a) preliminary figures

Source: Direktorat Jenderal Peternakan

When the First Development Plan (Repeleta I) was started in 1969, the livestock sector was traditional and meat production was about 309 000 t. Eggs and milk production were 57 700 t and 28 900 t, respectively. Soewardi and Atmadilaga pointed out that increasing per person income levels in Indonesia, particularly since the beginning of the second Five-year Development Plan in 1974, led to increased demand for livestock products. This increased demand resulted in the slaughter of many female cattle. The government allocated 5.1 percent of the total agricultural development budget to livestock in the second Five-year Development Plan and 6.4 percent for the third Plan. In this plan, the government intended that the production of eggs, meat and milk should be increased to meet demand and that the population of ruminants should increase by 1 percent or 2 percent a year.

Kristanto (1982) argued that cattle are an important part of the Indonesian economy. As evidence, he cited the fact that in 1973 about 13 percent of Indonesia's smallholders, accounting for 60 percent of the total population, were engaged in cattle production and crop raising. Twenty years later in 1993, about 5 600 000 Indonesian households or about 26 percent of rural households were in livestock production. All but 291 000 of Indonesia's livestock households were classified as rural households. The number of households in livestock husbandry in 1993 was almost 27 percent above the number in 1983. Provinces where relatively large increases occurred were Lampung (the province on Sumatra (Sumatera)

located closest to the heavily populated province of West Java and Jakarta), Maluku (between Irian Jaya and Sulawesi) and Timor-Timur (Table 9).

In general the farm households involved in livestock production practise mixed farming, combining crops and livestock. For small farmers, livestock can provide benefits through sale of product and improved nutrition through increased consumption of meat, milk and eggs¹. Livestock are also used for ritual and ceremonial occasions, and recreation². Larger livestock – cattle and buffalo - are liquid assets that provide a hedge against inflation and can be converted to cash when the need arises³. The Food and Fertilizer Technology Center (1995) explains that investing in livestock enables small-scale upland farmers in Asia to spread their risks and to use profits from good years to help survive the bad years. Animals are also seen as a way of recycling nutrients for cropland areas.

¹ Nari (1992) summarizes research that has investigated the improvements that livestock can make to farmers' incomes in different parts of Indonesia.

² Ashdown (1992) describes how in South Sulawesi most ceremonies involve the sacrifice of animals, such as buffalo, pigs, horses or chickens. The slaughtering of buffalo at funerals for example is tied to the belief that the buffalo is "a vehicle to reach heaven" (p.240). Ashdown's view is that it is important for government workers to understand rural traditions since these may offer a reason for farmers adopting particular practices over others that may be more financially profitable.

³ Patrick and Vere (1992) claim that "the market price of cattle and buffaloes is a minor consideration in the smallholder farmer's perceived value of these animals" (p.188).

Table 9. Number of households engaged in animal husbandry, by province

Province	Urban		Rural		Total		Ratio of 1993/1983
	1983 (000)	1993 (000)	1983 (000)	1993 (000)	1983 (000)	1993 (000)	
DI Aceh	2	5	110	152	112	157	1.40
Sumatera Utara	10	14	174	231	184	245	1.33
Sumatera Barat	9	2	88	117	97	119	1.23
Riau	2	5	37	68	39	73	1.87
Jambi	1	1	40	47	41	48	1.17
Sumatera Selatan	6	4	75	124	81	128	1.58
Bengkulu	1	1	23	27	24	28	1.17
Lampung	3	3	90	196	93	199	2.14
DKI Jakarta	4	1	0	0	4	1	0.25
Jawa Barat	20	46	415	441	435	487	1.12
Jawa Tengah	31	58	692	848	723	906	1.25
DI Yogyakarta	4	25	97	128	101	153	1.51
Jawa Timur	50	72	1 232	1 454	1 282	1 526	1.19
Bali	5	10	161	195	166	205	1.23
Nusa Tenggara Barat	6	6	135	163	141	169	1.20
Nusa Tenggara Timur	3	6	184	243	187	249	1.33
Timor-Timur	0	1	33	59	33	60	1.82
Kalimantan Barat	2	4	98	140	100	144	1.44
Kalimantan Tengah	2	1	21	29	23	30	1.30
Kalimantan Selatan	2	1	35	58	37	59	1.59
Kalimantan Timur	5	3	18	34	23	37	1.61
Sulawesi Utara	3	4	72	87	75	91	1.21
Sulawesi Tengah	1	2	56	66	57	68	1.19
Sulawesi Selatan	9	9	306	301	315	310	0.98
Sulawesi Tenggara	0	2	23	40	23	42	1.83
Maluku	2	2	21	41	23	43	1.87
Irian Jaya	2	3	62	103	64	106	1.66
Indonesia	185	291	4 298	5 392	4 483	5 683	1.27

Source: Direktorat Jenderal Peternakan

About 30 percent of households in the livestock industries in 1993 had six or more family members, while 25.5 percent had fewer than four household members. The most likely age category for the farmer was 40 to 59 years, and few (10 percent) had been educated beyond primary school (Table 10). For those with another source of income, in 78.1 percent of cases it was likely to be agriculture (Table 11). The family plays an important part in livestock industries since much of the responsibility for looking after the animals is given to the farmer's spouse and children. As Nari (1992) explains, children in a West Java study were found to prefer to manage small animals and poultry rather than join their parents in cultivating crops. Children collected grasses from roadsides and vacant land as they returned home from school. In the dairy industry, the farmer's spouse and children are responsible for

delivering milk to collection points and for much of the day to day care of the cow (Hutabarat *et al.*, 1996).

Table 10. Characteristics of Indonesian livestock producers, 1993

Item	Number	Percentage
<i>Household size</i>		
< 4	1 377 817	25.5
4-5	2 401 156	44.5
6-7	1 224 886	22.7
> 7	390 409	7.2
Total	5 394 268	100.0
<i>Age</i>		
< 20 years	18 114	0.3
20-39	1 740 276	32.3
40-59	2 814 542	52.2
> 59	821 336	15.2
Total	5 394 268	100.0
<i>Education</i>		
no education	1 149 056	21.3
not completed primary school	1 833 111	34.0
primary school	1 874 353	34.7
junior high	305 691	5.7
senior high	210 038	3.9
university	22 019	0.4
Total	5 394 268	100.0

Source: Direktorat Jenderal Peternakan

Table 11. Main income sources of Indonesian farmers, 1993

Source	Number	Percentage
Other agriculture	4 215 204	78.1
Mining and quarrying	54 275	1.0
Industry/handicraft	87 786	1.6
Trade	254 098	4.7
Transport	78 987	1.5
Services	334 288	6.2
Income earner	110 697	2.1
Other	228 406	4.2
No other	30 527	0.6
Total	5 394 268	100.0

Source: Direktorat Jenderal Peternakan

As mentioned already, the majority of households engaged in livestock production rely on other agricultural industries for income. Livestock play an important part in crop production since they provide draught power, manure and add value to crop residues. They also make use of seasonal labour surpluses, or underemployed family labour⁴. The contribution to farmer welfare of livestock varies regionally and with farm wealth. Oka *et al.* (1992) say that in certain of the poorer regions of Indonesia, commonly those without natural resources and land suitable for irrigation, livestock play a more important role in the rural economy. They point out that livestock have been found to contribute a “greater proportion of household income in poorer families compared to similar wealthier families” (p.56).

⁴ According to Kasryo and Suryana (1992), underemployment (working less than 35 hours per week) in rural areas was relatively high at around 57% in 1990. The corresponding figure for urban areas was about 41%.

Now that a broad overview of the numbers of farmers involved in livestock production has been provided, the next part of this appendix will examine the industries making up the sector.

THE POULTRY INDUSTRY

The key priority of the Indonesian Government as far as the livestock sector is concerned is the expansion of the poultry industry, in particular the broiler industry. In 1997, about 816 million broilers were produced on Indonesian farms, more than 30 times the number in 1981 (Table 12). For the years shown in Table 12, both broilers and layers recorded rates of growth of over 16 percent compared to 5.2 percent for indigenous chickens and 4.4 percent for ducks. Policy makers see the broiler industry as an important source of animal protein because, in comparison with cattle, poultry are efficient converters of feed grains into meat.

Table 12. Poultry numbers in Indonesia, 1969 to 1997

Year	Indigenous chickens (000)	Poultry		
		Layers (000)	Broilers (000)	Ducks (000)
1969	61 788	688	na	7 269
1970	62 652	706	na	7 370
1971	73 841	1 799	na	10 416
1972	79 627	3 000	na	12 404
1973	79 906	2 202	na	12 503
1974	89 650	3 450	na	13 620
1975	94 572	3 903	na	14 123
1976	97 504	4 878	na	15 182
1977	101 686	5 807	na	16 032
1978	108 916	6 071	na	17 541
1979	114 350	7 007	na	18 069
1980	126 310	22 940	na	21 078
1981	132 878	24 568	25 462	22 420
1982	139 787	26 312	28 110	23 861
1983	159 462	28 102	31 033	23 781
1984	166 815	29 559	110 580	24 694
1985	155 627	31 875	143 657	23 870
1986	162 991	38 689	173 795	27 002
1987	168 405	39 968	218 183	26 025
1988	182 879	39 413	227 044	25 080
1989	191 433	40 452	262 918	24 315
1990	201 365	43 185	362 612	25 553
1991	208 966	46 885	407 908	25 369
1992	222 530	54 146	459 097	27 342
1993	222 893	54 736	528 159	26 618
1994	243 261	63 334	622 965	27 536
1995	250 080	68 897	689 467	29 616
1996	260 713	78 706	755 956	29 959
1997 ^(a)	270 756	85 471	816 784	31 177
Rate of growth ^(b)	5.2%	16.2%	21.5%	4.4%

Notes: na indicates not available; ^(a) preliminary;

^(b) Rate of growth is the coefficient on t in the regression $\ln(y) = a + b t$, where t is year

Source: Direktorat Jenderal Peternakan (1997), p.87.

The importance of poultry in raising Indonesian meat consumption is apparent from Figure 7. This shows that in 1997, over 50 percent of the meat consumed in Indonesia came from poultry. By comparison, in the early 1980s less than one third of the meat consumption recorded in the official statistics was poultry meat. Pork is not consumed by Muslims since they consider it unclean and *haram*. However, the Chinese, who tend to be more affluent than other Indonesians and make up about 3 percent of the population, consume large quantities. Beef and buffalo meat are not favoured by Indonesians because compared to poultry both meats are expensive. Meat from bovine animals is considered a *halal* food and this means it can be consumed by Muslims. All processed foods in Indonesia are generally labelled with a *halal* logo. The Department of Health and the Muslim Union control the issuing of the logo.

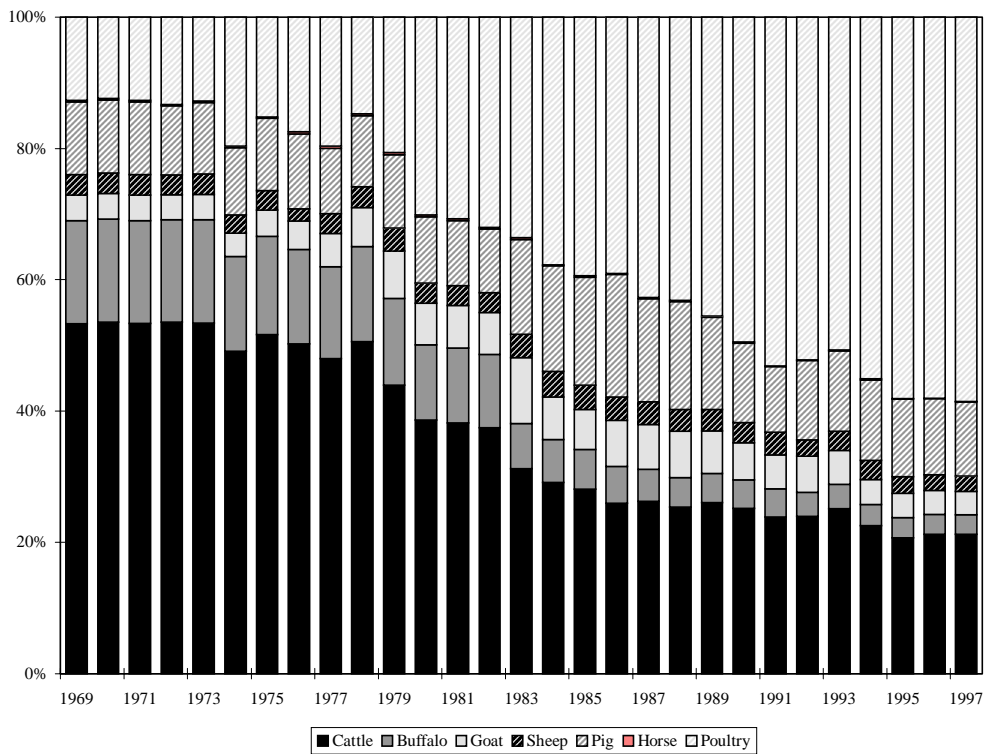


Figure 7. Consumption of meats by species, 1969 to 1997

Poultry meat comes from a number of different sources. As might be expected based upon the data presented earlier, chickens were the most important, with broilers (474 000 t) and native chicken (250 000 t) being dominant. The reason for the importance of chicken meat is that it is generally the least expensive to produce and to purchase. Figure 8 shows how the relative importance of native chickens, broilers, culled layers and ducks changed between 1984 and 1997.

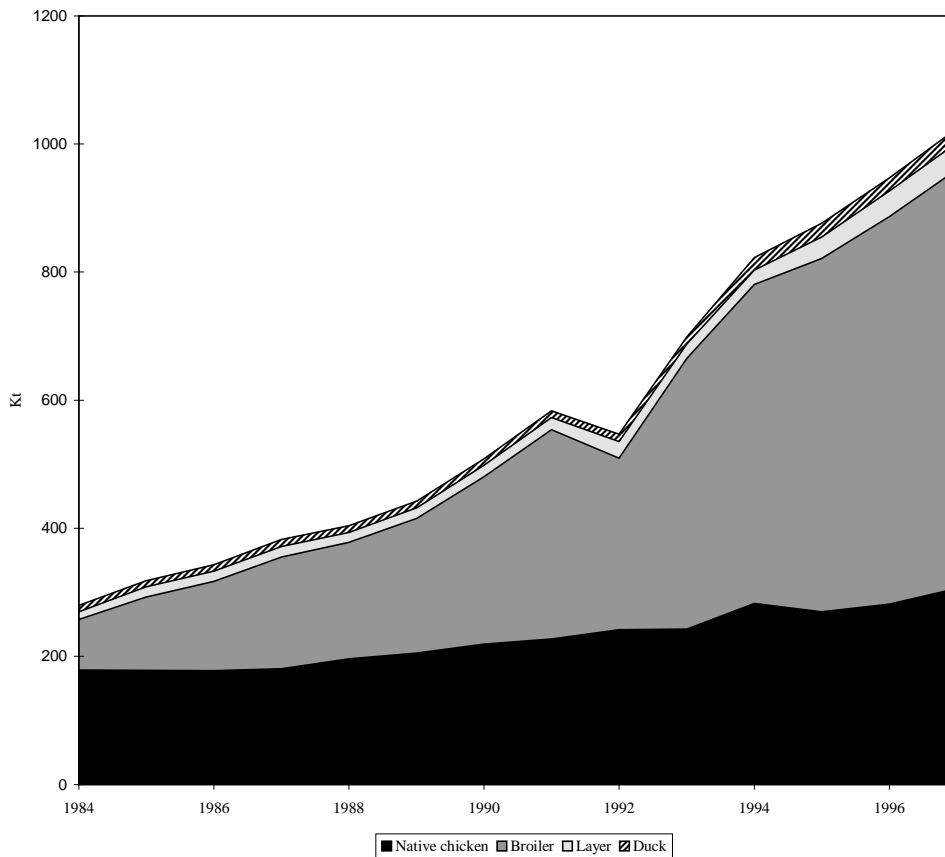


Figure 8. Consumption of poultry meat, 1984 to 1997

NATIVE CHICKEN

As indicated in the previous section and in Chapter 1 of this report native or indigenous chickens are an important part of the poultry industry. They require almost no inputs and help to maintain hygiene in rural villages through their scavenging activities. One really remarkable change has been the decline in the number of households keeping native chickens. According to information from the Direktorat Jenderal Peternakan, households with native chickens fell from over 13 million in 1973 to under 500 000 by 1993 (Table 13). This fall in household numbers with native chickens was accompanied by an increase in native chicken numbers from almost 80 million to 222 million. This suggests that the raising of native chickens has become more commercial, since the average household with native chickens had about 480 birds in 1993 as compared to around six in 1973. Native chickens are reared throughout Indonesia, with the highest numbers being found in Java.

Table 13. Number of native chicken households 1963, 1973, 1983 and 1993

Provinces	1963 ^(a)	1973	1983	1993 ^(b)
DI Aceh	240 575	242 266	19 076	31 000
Sumatera Utara	625 132	551 784	23 765	29 000
Sumatera Barat	233 188	250 965	12 011	17 000
Riau	130 005	140 795	15 505	31 000
Jambi	60 797	94 858	9 364	13 000
Sumatera Selatan	541 225	269 426	32 349	24 000
Bengkulu	0	52 414	3 656	5 000
Lampung	0	342 909	16 294	17 000
DKI Jakarta	15 740	87 567	403	0
Jawa Barat	1 584 465	2 688 941	36 083	44 000
Jawa Tengah	2 075 295	3 097 830	64 860	50 000
DI Yogyakarta	244 957	371 217	9 954	13 000
Jawa Timur	2 528 295	3 492 130	44 696	46 000
Bali	237 776	309 685	14 516	15 000
Nusa Tenggara Barat	191 605	237 914	10 999	9 000
Nusa Tenggara Timur	236 972	237 492	14 618	15 000
Timor-Timur	0	0	335	1 000
Kalimantan Barat	197 438	211 147	14 022	18 000
Kalimantan Tengah	56 314	61 621	7 157	8 000
Kalimantan Selatan	132 168	106 763	9 326	12 000
Kalimantan Timur	47 579	44 499	6 654	11 000
Sulawesi Utara	200 493	165 196	7 567	9 000
Sulawesi Tengah	0	78 786	5 266	8 000
Sulawesi Selatan	409 906	621 581	22 600	28 000
Sulawesi Tenggara	0	56 045	6 268	7 000
Maluku	0	51 769	4 207	11 000
Irian Jaya	0	0	3 331	8 000
Indonesia		13 865 600	414 882	480 000

Notes: ^(a) Poultry household; ^(b) Preliminary figure

Source: Direktorat Jenderal Peternakan (1996), p57.

According to official statistics, Indonesia's population of native chickens increased by about 74 percent between 1985 and 1997. Many provinces (for example Lampung, Nusa Tenggara Timur and Kalimantan Barat) more than doubled their numbers. However, obtaining an accurate census of native chickens would not be easy and so there must be some doubt about the growth in numbers reported for 1985 to 1997 and shown in Table 14.

Table 14. Native chicken population 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/ 1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	7 280	9 645	10 079	10 285	12 134	12 705	13 643	15 107	15 711	5.80	2.16
Sumatera Utara	9 767	11 237	12 175	12 748	13 669	15 585	17 358	19 165	21 160	7.82	2.17
Sumatera Barat	5 420	8 171	8 816	9 363	9 540	9 525	9 922	10 187	10 460	3.86	1.93
Riau	2 069	2 947	3 107	2 764	3 343	3 498	3 734	3 913	4 100	1.51	1.98
Jambi	1 685	2 824	3 092	3 228	3 456	3 735	3 917	4 108	4 318	1.59	2.56
Sumatera Selatan	5 270	7 237	7 267	10 045	10 393	12 110	12 925	14 350	15 600	5.76	2.96
Bengkulu	2 612	4 021	4 026	4 043	4 061	4 078	4 081	4 163	4 246	1.57	1.63
Lampung	4 500	9 213	10 012	10 720	11 398	18 759	13 409	14 068	14 765	5.45	3.28
DKI Jakarta	242	702	702	252	222	153	114	128	127	0.05	0.52
Jawa Barat	19 436	28 278	28 468	31 669	36 121	36 702	35 555	36 193	35 068	12.95	1.80
Jawa Tengah	23 897	29 454	29 784	31 092	31 239	31 479	33 580	34 328	35 093	12.96	1.47
DI Yogyakarta	4 039	4 829	4 831	4 904	4 978	5 044	5 053	5 054	5 100	1.88	1.26
Jawa Timur	26 252	29 511	30 106	30 675	31 012	31 105	33 565	34 286	37 098	13.70	1.41
Bali	3 714	5 432	5 380	5 685	5 987	6 130	6 313	6 349	6 462	2.39	1.74
Nusa Tenggara Barat	3 252	3 974	5 713	4 115	4 545	4 937	5 286	5 674	6 178	2.28	1.90
Nusa Tenggara Timur	3 313	4 391	4 527	6 139	6 767	7 123	7 614	7 805	8 000	2.95	2.41
Timor-Timur	409	514	551	581	613	498	526	555	585	0.22	1.43
Kalimantan Barat	2 043	2 295	2 332	2 717	3 023	3 368	3 503	4 673	4 953	1.83	2.42
Kalimantan Tengah	1 650	1 629	1 674	1 707	2 082	2 305	2 358	2 477	2 750	1.02	1.67
Kalimantan Selatan	4 104	4 647	4 801	4 437	4 797	4 980	5 193	5 356	5 443	2.01	1.33
Kalimantan Timur	2 010	2 632	2 374	3 022	3 214	3 557	3 738	4 139	4 324	1.60	2.15
Sulawesi Utara	1 247	1 510	1 541	1 705	1 790	1 880	1 974	2 072	2 176	0.80	1.74
Sulawesi Tengah	1 417	2 788	3 267	3 832	4 493	2 774	3 260	2 504	2 566	0.95	1.81
Sulawesi Selatan	15 388	15 911	16 296	19 127	6 577	13 359	14 924	14 949	14 962	5.53	0.97
Sulawesi Tenggara	2 850	5 357	5 500	4 807	4 372	4 978	5 528	5 824	6 115	2.26	2.15
Maluku	1 164	1 290	1 329	1 507	1 566	1 670	1 743	1 957	2 000	0.74	1.72
Irian Jaya	603	928	1 217	1 363	1 503	1 229	1 269	1 329	1 395	0.52	2.31
Indonesia	155 629	201 366	208 966	222 530	222 893	243 260	250 080	260 713	270 756	100.0	1.74

Notes:^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.96 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.85 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.8 for 1985 data.

Native chicken contributed about 300 000 t of meat to poultry meat production in 1997. This was about 30 percent of poultry meat production. As Table 15 shows, the major producing area was Jawa Tengah (Central Java) with almost one fifth of production. The three Javanese provinces accounted for about 44 percent of native chicken meat production. Most provinces increased their output of native chicken meat by 10 percent or more between 1990 and 1997.

Table 15. Native chicken meat production 1990 to 1997, by province

Provinces	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	10.5	11.0	11.2	13.2	7.7	10.1	9.2	16.5	5.38	1.57
Sumatera Utara	12.2	13.2	13.9	14.9	19.6	30.3	23.8	24.2	7.91	1.98
Sumatera Barat	8.9	9.6	10.2	10.4	10.2	10.6	10.9	11.2	3.67	1.26
Riau	3.2	3.4	3.0	3.6	3.2	2.7	4.2	4.4	1.44	1.37
Jambi	3.1	3.4	3.5	3.8	4.1	4.5	4.8	5.3	1.72	1.71
Sumatera Selatan	7.9	7.9	10.9	11.3	11.3	14.0	16.7	17.4	5.68	2.21
Bengkulu	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.6	1.51	1.06
Lampung	10.0	10.9	11.7	12.4	19.2	18.6	18.2	19.1	6.25	1.91
DKI Jakarta	0.8	0.8	0.3	0.2	0.2	0.0	0.2	0.2	0.07	0.26
Jawa Barat	30.8	31.0	34.4	39.3	39.4	37.5	38.2	37.4	12.23	1.22
Jawa Tengah	32.0	32.4	33.8	34.0	74.6	40.7	49.7	60.7	19.85	1.90
DI Yogyakarta	5.3	5.3	5.3	5.4	5.5	5.4	5.4	5.5	1.79	1.04
Jawa Timur	32.1	32.7	33.4	33.7	33.5	36.5	37.5	37.4	12.23	1.17
Bali	5.9	5.9	6.2	6.5	6.1	7.1	7.6	8.6	2.80	1.45
Nusa Tenggara Barat	4.3	6.2	4.5	4.9	3.3	3.0	3.8	4.1	1.35	0.95
Nusa Tenggara Timur	4.8	4.9	6.7	7.4	6.8	8.2	8.2	8.2	2.69	1.72
Timor-Timur	0.6	0.6	0.6	0.7	0.3	0.6	0.6	0.7	0.22	1.20
Kalimantan Barat	2.5	2.5	3.0	3.3	3.5	3.5	4.6	4.9	1.60	1.96
Kalimantan Tengah	1.8	1.8	1.9	2.3	1.4	1.5	1.6	2.0	0.66	1.15
Kalimantan Selatan	5.1	5.2	4.8	5.2	5.1	5.3	5.6	5.7	1.88	1.14
Kalimantan Timur	2.9	2.6	3.3	3.5	3.5	3.8	4.0	4.4	1.45	1.55
Sulawesi Utara	1.6	1.7	1.9	2.0	2.0	2.2	2.3	2.4	0.77	1.45
Sulawesi Tengah	3.0	3.6	4.2	4.9	2.9	3.6	2.7	2.8	0.91	0.92
Sulawesi Selatan	17.3	17.7	20.8	7.2	7.0	7.8	8.5	9.0	2.94	0.52
Sulawesi Tenggara	5.8	6.0	5.2	4.8	4.8	5.2	5.8	6.5	2.11	1.11
Maluku	1.4	1.5	1.6	1.7	1.7	1.7	1.9	2.0	0.64	1.39
Irian Jaya	1.0	1.3	1.5	1.6	0.8	0.8	0.9	0.9	0.29	0.88
Indonesia	219.0	227.2	242.0	242.4	282.1	269.4	281.5	306.0	100.00	1.40

Notes: ^(a) preliminary

Source: Direktorat Jenderal Peternakan (1997) p.110 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.98 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data

BROILER CHICKENS

The production of meat through the broiler industry has increased dramatically in Indonesia. Until the 1997 crisis in the economy, the large intensive farms were generally operated by the private sector. Production of broiler meat in 1997 was 653 600 t, about double the level of five years earlier and more than five times the production level in 1985. Jawa Barat (West Java), Jawa Tengah (Central Java) and Sumatera Utara were the main producing provinces, providing in aggregate more than 65 percent of Indonesia's broiler production. Jawa Tengah and DI Yogyakarta showed production increases of more than 500 percent between 1985 and 1997 (Table 16).

The farms producing broiler chickens employ modern technologies. This also involves the use of imported feed grains, imported grandparent stock and vaccines and medicines. The

dependence on imports has created substantial problems for the Indonesian authorities following the rapid and substantial depreciation of the Indonesian rupiah in late 1997. According to some reports, poultry numbers on broiler farms in the early part of 1998 were down to 30 percent of their “normal” level. Most small farms were reported to have ceased operation. Consumer demand for chicken meat had been sharply reduced by the doubling of poultry prices. Dressed broilers for example doubled in price from Rp. 5 500 in late November 1997 to Rp. 11 000 per bird by March 1998. Likewise egg prices over this period increased from Rp. 2 650 per kg to Rp. 5 000 per kg.

Table 17 presents data for the period 1985 to 1995 on the numbers of broilers turned off for processing. The production in 1995 was almost 670 million birds, over 50 times the number produced in 1985. Sixteen provinces at least tripled the number of broilers produced between 1985 and 1995. Not surprisingly, the pattern of turn-off was similar to the production pattern for broiler meat with the highest production occurring in Jawa Barat and Jawa Tengah, provinces close to Jakarta. Industry sources say that about 93 percent of the broiler production is consumed on Java and Bali.

Table 16. Broiler meat production 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.6	0.4	1.1	0.6	0.8	1.3	0.5	0.8	0.9	0.14	1.43
Sumatera Utara	19.7	28.2	30.5	33.0	37.2	45.1	52.1	59.2	67.3	10.30	3.42
Sumatera Barat	0.0	2.7	3.0	5.0	4.6	5.3	5.6	6.6	8.2	1.25	nc
Riau	0.0	16.4	16.9	20.4	16.4	10.9	11.0	12.6	12.8	1.95	nc
Jambi	3.7	6.2	6.5	7.8	7.3	8.7	1.9	2.4	2.4	0.37	0.65
Sumatera Selatan	2.9	9.0	16.3	3.0	5.5	5.5	5.9	10.1	13.0	1.99	4.48
Bengkulu	1.3	2.8	2.8	3.0	2.8	3.5	4.9	2.5	2.5	0.39	1.93
Lampung	0.0	1.4	3.5	6.8	8.0	8.6	15.7	20.4	24.9	3.81	nc
DKI Jakarta	0.0	3.6	3.6	2.3	1.5	1.2	1.1	1.1	1.1	0.17	nc
Jawa Barat	44.4	63.8	87.3	106.2	129.3	143.5	189.4	233.2	247.8	37.91	5.58
Jawa Tengah	1.4	32.5	52.0	60.6	78.8	92.4	134.5	116.8	118.3	18.10	84.51
DI Yogyakarta	1.9	6.0	6.1	6.2	6.8	7.7	9.2	12.0	13.6	2.09	7.14
Jawa Timur	10.6	24.1	27.1	39.5	59.1	76.7	38.6	38.6	40.2	6.15	3.79
Bali	3.9	6.8	7.0	7.1	7.4	10.5	13.7	12.9	15.5	2.37	3.97
Nusa Tenggara Barat	0.1	1.1	1.1	0.0	0.0	0.0	1.4	0.0	0.0	0.00	0.00
Nusa Tenggara Timur	0.0	2.1	2.2	0.7	2.1	4.6	0.7	0.7	0.7	0.10	nc
Timor-Timur	0.0	1.5	2.0	2.2	2.2	2.3	0.4	0.4	0.4	0.07	nc
Kalimantan Barat	2.9	4.4	5.4	5.1	5.6	9.7	8.0	11.7	14.3	2.18	5.00
Kalimantan Tengah	2.8	16.4	18.0	0.0	4.0	10.8	1.4	1.7	1.7	0.27	0.63
Kalimantan Selatan	0.0	5.1	5.2	6.3	4.2	5.6	5.2	5.6	5.8	0.88	nc
Kalimantan Timur	6.7	10.3	12.3	10.8	10.0	16.3	19.4	18.3	19.8	3.03	2.98
Sulawesi Utara	2.5	5.1	5.5	7.3	8.8	10.3	1.9	2.4	2.5	0.38	0.99
Sulawesi Tengah	0.0	0.0	0.0	0.0	0.1	1.0	2.8	5.0	5.7	0.86	nc
Sulawesi Selatan	0.0	1.4	1.6	21.7	12.3	4.4	24.7	27.9	32.1	4.92	nc
Sulawesi Tenggara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	nc
Maluku	1.3	4.2	5.0	4.3	3.8	6.2	0.9	0.9	0.9	0.14	0.71
Irian Jaya	7.8	5.7	4.5	4.6	4.5	6.5	0.9	1.1	1.2	0.18	0.15
Indonesia	114.5	261.4	326.4	367.4	422.7	498.5	551.7	605.0	653.6	100.00	5.71

Notes: ^(a) preliminary

Source: Direktor Jenderal Peternakan (1997), p.112 for 1994 to 1997 data; Direktor Jenderal Peternakan (1996), p.100 for 1990 to 1994 data; Direktor Jenderal Peternakan (1988), p.32 for 1985 data

Table 17. Broiler turn-off 1985 to 1995, by province

Provinces	1985 (000)	1990 (000)	1991 (000)	1992 (000)	1993 (000)	1994 (000)	1995 ^(a) (000)	1995/1985
DI Aceh	65	58	152	74	106	196	299	4.63
Sumatera Utara	2 049	3 796	4 107	4 444	5 012	6 943	8 021	3.91
Sumatera Barat	0	363	400	673	616	807	863	nc
Riau	439	2 214	2 276	2 746	2 210	1 675	1 894	4.32
Jambi	390	828	870	1 056	986	1 344	2090	5.36
Sumatera Selatan	302	1 210	2 196	810	735	853	904	2.99
Bengkulu	136	379	383	407	373	540	749	5.50
Lampung	0	191	475	912	1 076	1 330	1 330	nc
DKI Jakarta	668	487	487	312	208	183	167	0.25
Jawa Barat	4 620	8 587	11 760	14 306	17 409	22 086	29 151	6.31
Jawa Tengah	143	4 380	7 001	8 154	10 605	14 224	20 704	144.48
DI Yogyakarta	199	813	815	830	913	1 187	1416	7.11
Jawa Timur	1 102	3 242	3 643	5 321	7 951	11 806	6 923	6.28
Bali	406	911	936	958	999	1 609	2 109	5.20
Nusa Tenggara Barat	9	146	146	0	0	0	0	nc
Nusa Tenggara Timur	0	288	297	95	278	700	732	nc
Timor-Timur	2	205	272	299	289	358	405	183.88
Kalimantan Barat	297	597	723	682	753	1 488	1 081	3.64
Kalimantan Tengah	288	2 214	2 420	0	534	1 654	1 676	5.82
Kalimantan Selatan	0	692	701	845	568	865	937	nc
Kalimantan Timur	693	1 385	1 656	1 449	1 342	2 511	2 992	4.32
Sulawesi Utara	262	690	744	976	1 180	1 579	1 582	6.03
Sulawesi Tengah	0	1	1	5	7	159	160	nc
Sulawesi Selatan	0	189	213	2 924	1 650	681	738	nc
Sulawesi Tenggara	0	0	0	0	0	0	0	nc
Maluku	132	568	674	580	514	951	951	7.22
Irian Jaya	817	762	610	614	600	992	960	1.18
Indonesia	13 018	326 612	407 908	459 097	528 159	622 965	669 793	51.45

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (pers.comm.) for 1995 data; Direktorat Jenderal Peternakan (1996), p.87 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.8 for 1985 data.

To gain some idea of how productivity in the broiler industry has changed since 1985, the ratio of production to turn-off was calculated for 1995 and 1985. The values exhibited considerable variability, ranging from less than 1.0 in some provinces to over 10 in other provinces. This suggests that the official data may not be completely reliable. Large broiler producing farms are on Java. It was thought the data might be more accurate for these provinces and for this reason the ratio of production to turn-off in the three Javanese

provinces as well as DI Yogyakarta were calculated. The results in Figure 9 show the ratio of production to turn-off has fallen from values of over nine in 1985 to just over six in 1995. This suggests that broilers in 1985 spent about 40 days in the broiler farms and about 60 days in 1995.

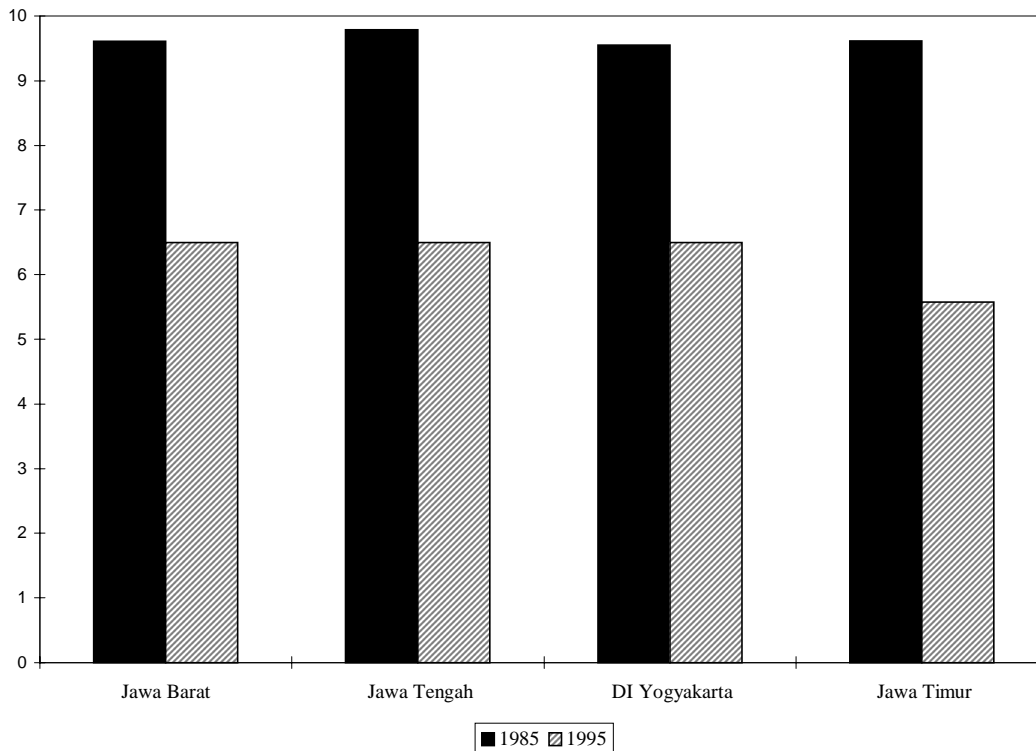


Figure 9. The ratio of production to turn-off in the broiler industry, selected provinces, 1985 and 1995

Poultry meat is obtained not only from native chickens and the intensive broiler industry but also from cull chickens from egg producing farms. In 1997, culls provided about 43 000 t of poultry meat (Table 18).

Table 18. Cull chicken meat production 1990 to 1997 by province

Provinces	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1990
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.08	0.05	0.05	0.04	0.1	0.098	0.084	0.091	0.21	1.14
Sumatera Utara	1.15	1.2	1.67	1.33	2.05	1.979	0.242	0.254	0.60	0.22
Sumatera Barat	0.75	0.77	0.89	0.83	0.67	0.678	0.647	0.666	1.56	0.89
Riau	0.22	0.29	0.35	0.31	0.21	0.248	0.248	0.302	0.71	1.37
Jambi	0.08	0.07	0.1	0.1	0.09	0.102	0.119	0.138	0.32	1.73
Sumatera Selatan	0.45	0.57	0.42	0.38	0.25	0.321	0.327	0.347	0.81	0.77
Bengkulu	0.02	0.02	0.02	0.02	0.01	0.012	0.018	0.026	0.06	1.30
Lampung	0.42	0.54	1.02	0.97	0.84	0.916	0.987	1.409	3.30	3.35
DKI Jakarta	0.02	0.02	0.01	0.01	0.01	0	7.3	7.6	17.82	380.00
Jawa Barat	4.02	4.11	6.69	5.82	11.27	7.112	6.179	7.511	17.61	1.87
Jawa Tengah	2.11	2.29	2.74	2.36	3.55	10.505	9.867	9.268	21.73	4.39
DI Yogyakarta	0.93	0.93	1.06	0.96	0.96	0.993	0.916	0.95	2.23	1.02
Jawa Timur	4.75	5.38	7.3	6.03	0.66	6.891	7.786	7.717	18.10	1.62
Bali	0.53	0.62	0.73	0.65	0.64	0.927	1.115	1.475	3.46	2.78
Nusa Tenggara Barat	0.07	0.1	0.09	0.09	0.09	0.106	1.68	1.863	4.37	26.61
Nusa Tenggara Timur	0.21	0.22	0.21	0.19	0.04	0.045	0.049	0.053	0.12	0.25
Timor-Timur	0.01	0.01	0.01	0.01	0.08	0.013	0.015	0.016	0.04	1.60
Kalimantan Barat	0.26	0.31	0.57	0.56	0	0	0	0	0.00	0.00
Kalimantan Tengah	0.03	0.04	0.05	0.04	0.1	0.019	0.016	0.018	0.04	0.60
Kalimantan Selatan	0.14	0.14	0.22	0.21	0.13	0.153	0.233	0.273	0.64	1.95
Kalimantan Timur	0.23	0.18	0.19	0.17	0.22	0.226	0.25	0.267	0.63	1.16
Sulawesi Utara	0.31	0.33	0.03	0.38	0.37	0.386	0.392	0.393	0.92	1.27
Sulawesi Tengah	0.07	0.08	0.09	0.09	0.13	0.114	0.111	0.113	0.26	1.61
Sulawesi Selatan	0.81	0.92	1.23	0.89	0	1.165	1.408	1.74	4.08	2.15
Sulawesi Tenggara	0.01	0.01	0.01	0.01	0.01	0.01	0.019	0.03	0.07	3.00
Maluku	0.04	0.05	0.05	0.04	0.04	0.038	0.04	0.042	0.10	1.05
Irian Jaya	0.09	0.09	0.1	0.1	0.08	0.065	0.08	0.085	0.20	0.94
Indonesia	17.81	19.34	25.91	22.58	22.59	33.122	40.129	42.647	100.00	2.39

Notes: ^(a) preliminary

Source: Direktorat Jenderal Peternakan (1997), p.111 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.99 for 1990 to 1994 data

EGG PRODUCTION

Eggs are produced by native chickens, layers and ducks. Their combined production increased by a factor of fourteen between 1969 and 1997. This represents an annual average growth rate of about 9.9 percent. The most dramatic increases occurred for layers. Production from layer hens went from 4 200 t in 1969 to 535 900 t in 1997, an annual average growth of 16.2 percent. In 1995, Indonesia had just over 69 million layers, and they were concentrated on

Java. Production from ducks and native chickens also increased over the period 1969 to 1997 by 7.2 percent and 5.5 percent, respectively (Table 19).

Table 19. Egg production, 1969 to 1997

Year	Native chicken (kt)	Layer (kt)	Duck (kt)	Total (kt)
1969	30.9	4.2	22.6	57.7
1970	31.3	4.3	23	58.6
1971	33.2	10.9	24.3	68.4
1972	23.4	18.2	25.9	67.5
1973	35.4	15.6	30.4	81.4
1974	36.1	24.8	37.2	98.1
1975	41.2	28	43	112.2
1976	40.5	31.9	43.2	115.6
1977	43.4	39.4	48.6	131.4
1978	45.7	43.7	61.6	151
1979	48.6	50.3	65.6	164.5
1980	50.4	141.6	70.6	262.6
1981	43	151.7	70.5	275.2
1982	55.8	164.9	76.3	297
1983	58	176.6	81.4	316
1984	65.9	207.3	82.1	355.3
1985	65.4	227.2	77.3	369.9
1986	69.5	250.7	117	437.2
1987	70.7	259	121.8	451.5
1988	76.8	248.9	117.4	443.1
1989	80.4	262	113.8	456.2
1990	84.6	279.8	119.6	484
1991	87.8	303.8	118.8	510.4
1992	93.5	350.8	128	572.3
1993	93.6	354.7	124.6	572.9
1994	119.5	423.5	145.6	688.6
1995	125.3	457	153.8	736.1
1996	128.8	500.6	150.4	779.8
1997 ^(a)	128.2	535.9	153.9	818
Growth rate ^(b)	5.5%	16.2%	7.2%	9.9%

Notes: ^(a) Preliminary ^(b) Rate of growth is the coefficient on t in the regression $\ln(y) = a + b t$, where t is year
Source: Direktorat Jenderal Peternakan (1997), p.114 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.102 for 1969 to 1994

Over half of Indonesia's layers were in Java's three provinces in 1997; Jawa Timur accounted for 23 percent, Jawa Barat 19 percent and Jawa Tengah 12 percent. Between 1985 and 1997, layer population in Indonesia as a whole increased by about 169 percent, with the greatest increases occurring in Lampung, Sulawesi Selatan, Nusa Tenggara Barat, Jawa Timur (East Java) and Timor-Timur (East Timor). With the exception of Jawa Timur, each of these increases occurred from a relatively low base (Table 20). The increases in egg production mirrored the increase in layer numbers. For all of Indonesia, the increase was 150 percent between 1985 and 1997 (Table 21).

Table 20. Layer population 1985 to 1997, by province

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	%	
DI Aceh	63	175	106	77	83	80	168	184	181	0.21	2.87
Sumatera Utara	2 433	2 413	2 515	3 005	2 773	3 985	4 469	4 875	5 123	5.99	2.11
Sumatera Barat	1 399	1 568	1 604	1 601	1 731	1 620	1 643	1 570	1 613	1.89	1.15
Riau	415	469	596	617	642	559	602	733	891	1.04	2.15
Jambi	204	158	150	184	202	249	262	276	325	0.38	1.59
Sumatera Selatan	522	934	1 186	752	799	806	984	1 060	1 200	1.40	2.30
Bengkulu	2 612	37	39	37	37	38	38	55	80	0.09	0.03
Lampung	567	888	1 127	1 831	2 034	2 193	2 394	3 415	3 958	4.63	6.98
	0	0	0	0							
DKI Jakarta	965	32	32	30	30	27	21	10	10	0.01	0.01
Jawa Barat	8 538	8 401	8 587	12 069	12 166	13 655	13 287	15 280	16 275	19.04	1.91
Jawa Tengah	4 064	4 402	4 795	4 939	4 926	6 865	8 068	9 126	10 324	12.08	2.54
DI Yogyakarta	1 730	1 953	1 953	1 892	1 997	2 336	2 403	2 219	2 300	2.69	1.33
Jawa Timur	6 092	9 923	11 247	13 147	12 593	13 610	15 910	18 540	19 665	23.01	3.23
Bali	961	1 124	1 305	1 318	1 355	1 477	1 634	1 727	1 848	2.16	1.92
Nusa Tenggara Barat	85	146	219	163	180	184	191	290	370	0.43	4.36
Nusa Tenggara Timur	218	454	468	380	398	106	110	104	98	0.11	0.45
Timor-Timur	3	15	17	19	21	25	27	30	33	0.04	10.87
Kalimantan Barat	1 171	536	648	1 029	1 177	1 562	1 806	2 115	2 289	2.68	1.95
Kalimantan Tengah	116	57	79	79	85	45	46	38	38	0.04	0.32
Kalimantan Selatan	328	284	283	402	434	409	457	662	728	0.85	2.22
Kalimantan Timur	390	473	377	336	346	548	606	646	674	0.79	1.73
Sulawesi Utara	475	646	697	71	800	779	793	793	802	0.94	1.69
Sulawesi Tengah	90	145	160	177	196	278	231	225	227	0.27	2.53
Sulawesi Selatan	579	1 703	1 919	2 215	1 853	2 816	2 823	3 413	4 127	4.83	7.13
Sulawesi Tenggara	41	23	25	25	26	24	47	62	75	0.09	1.82
Maluku	132	92	99	87	93	99	102	106	111	0.13	0.84
Irian Jaya	196	178	185	196	208	225	273	296	317	0.37	1.62
Indonesia	31 785	43 185	46 885	54 146	54 736	63 335	68 897	78 706	85 471	100.0	2.69

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1996), p.86 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.8 for 1985 data.

Table 21. Layer egg production 1985 to 1997, by province

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.4	1.3	0.8	0.6	0.6	0.5	1.1	1.4	1.4	0.26	3.25
Sumatera Utara	16.6	18.1	18.9	22.6	20.9	29.3	34.7	40.0	40.0	7.46	2.42
Sumatera Barat	9.5	11.8	12.1	12.0	13.0	10.5	10.6	10.2	10.5	1.95	1.10
Riau	2.8	3.5	4.5	4.6	4.8	3.3	3.9	3.9	4.7	0.89	1.68
Jambi	1.4	1.2	1.1	1.4	1.5	1.3	1.6	1.9	2.2	0.42	1.60
Sumatera Selatan	3.6	7.0	8.9	5.7	6.0	5.5	7.6	8.9	9.4	1.76	2.66
Bengkulu	0.7	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.5	0.10	0.74
Lampung	3.9	6.7	8.5	13.8	15.3	14.7	16.8	17.3	24.7	4.61	6.42
DKI Jakarta	6.6	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.02	0.02
Jawa Barat	58.1	63.2	64.5	90.7	91.5	123.0	119.6	137.6	147.8	27.57	2.54
Jawa Tengah	27.6	33.1	36.1	37.1	37.0	55.2	74.1	77.0	79.9	14.92	2.89
DI Yogyakarta	11.8	14.7	14.7	14.2	15.0	15.1	15.6	14.4	14.9	2.78	1.27
Jawa Timur	41.4	74.6	84.5	98.8	94.7	104.9	110.3	120.6	123.4	23.04	2.98
Bali	6.5	8.5	9.8	9.9	10.2	9.6	10.6	11.2	11.2	2.09	1.72
Nusa Tenggara Barat	0.6	1.1	1.7	1.2	1.4	1.1	1.2	0.8	0.8	0.15	1.38
Nusa Tenggara Timur	1.5	3.4	3.5	2.9	3.0	0.7	0.8	0.6	0.5	0.09	0.34
Timor-Timur	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.04	10.15
Kalimantan Barat	8.0	4.0	4.9	7.7	8.9	10.1	13.1	13.7	17.7	3.31	2.23
Kalimantan Tengah	0.8	0.4	0.6	0.6	0.6	0.3	0.3	0.2	0.2	0.05	0.31
Kalimantan Selatan	2.2	2.1	2.1	3.0	3.3	2.7	3.0	4.3	4.4	0.82	1.98
Kalimantan Timur	2.7	3.6	2.8	2.5	2.6	3.4	3.6	3.9	4.2	0.78	1.58
Sulawesi Utara	3.2	4.9	5.2	0.5	6.0	5.0	5.1	5.1	5.2	0.97	1.61
Sulawesi Tengah	0.6	1.1	1.2	1.3	1.5	2.1	1.8	1.7	1.8	0.33	2.89
Sulawesi Selatan	3.9	12.8	14.4	16.7	13.9	22.3	18.3	22.1	26.7	4.99	6.79
Sulawesi Tenggara	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.5	0.09	1.72
Maluku	0.9	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.13	0.80
Irian Jaya	1.3	1.3	1.4	1.5	1.6	1.5	1.8	1.9	2.1	0.38	1.54
Indonesia	216.8	279.8	303.8	350.9	354.7	423.5	457.0	500.6	535.9	100.00	2.47

Notes: ^(a) Preliminary Source: Direktorat Jenderal Peternakan (1997), p.117 for 1994 to 1997 data, Direktorat Jenderal Peternakan (1996), p.104 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.37 for 1985 data.

Combining the government statistics in Tables 20 and 21, each layer produced about 6.8 kg of eggs in 1997, while in 1985, the production per bird was about 6.3 kg. There was very little variability between provinces, with all but four provinces in 1985 and two provinces in 1997 recording production per bird of 6 kg or better.

It is difficult to compare the census data on household numbers involved in raising broilers and layers because the series published are not consistently defined. Despite this caveat, Table 22 contains information available from official statistics.

Table 22. Number of layer/broiler households 1973, 1983 and 1993

Provinces	1973 ^(a)	1983 ^(a)	1993 ^(b)	1993 ^{(c) (d)}
DI Aceh	11 451	745	2 000	1 000
Sumatera Utara	3 667	2 175	2 000	1 000
Sumatera Barat	4 239	2 624	2 000	1 000
Riau	1 006	738	0	0
Jambi	370	814	0	0
Sumatera Selatan	2 610	2 324	1 000	1 000
Bengkulu	400	858	0	0
Lampung	1 865	1 877	1 000	0
DKI Jakarta	2 582	585	3 000	0
Jawa Barat	20 890	14 806	5 000	10 000
Jawa Tengah	24 899	19 231	2 000	9 000
DI Yogyakarta	3 848	9 401	13 000	3 000
Jawa Timur	28 804	20 205	3 000	7 000
Bali	3 237	2 962	1 000	2 000
Nusa Tenggara Barat	1 775	1 027	0	0
Nusa Tenggara Timur	1 416	836	0	0
Timor-Timur	0	20	0	0
Kalimantan Barat	1 252	1 181	0	0
Kalimantan Tengah	0	582	0	0
Kalimantan Selatan	818	0	0	1 000
Kalimantan Timur	137	2 092	1 000	1 000
Sulawesi Utara	1 073	703	0	0
Sulawesi Tengah	101	343	2 000	0
Sulawesi Selatan	2 406	2 513	0	0
Sulawesi Tenggara	265	145	1 000	0
Maluku	1 055	539	0	1 000
Irian Jaya	0	696	0	0
Indonesia	120 166	90 022	39 000	38 000

Notes: ^(a)Layer and broiler household; ^(b)Layer household; ^(c)Broiler household
^(d)Preliminary figure

Source: Direktorat Jenderal Peternakan (1996), p.58.

The data in Table 22 show that there were about 120 000 households producing layers and/or broilers in 1973, and about 77 000 involved in one or other of these activities in 1993. The decline in household numbers came at a time when layer and broiler numbers were both increasing very rapidly. This was due to the small farms closing because of their inability to compete with the large vertically integrated producers. At various times, representatives of the small producers have requested the government to require that large producers export 65 percent of their output instead of selling domestically. Since May 1990, foreign poultry producers have been required to export 65 percent of their output.

Table 23. Ownership of large poultry farms in 1991 and 1992^(a)

Province	1991					1992				
	Govt ^(b)	Public	Individual	Other	Total	Govt	Public	Individual	Other	Total
Sumatera Utara		3	90		93		3	108		111
Sumatera Barat		1	11		12		1	11		12
Riau	2		30		32	2	4	31	1	38
Jambi			1		1			1		1
Sumatera Selatan		1	2		3		1	2		3
Lampung		1	5		6		1	5		6
DKI Jakarta			3		3		3	8		11
Jawa Barat	4	31	273		308	4	31	273		308
Jawa Tengah		2	108		110		4	106		110
DI Yogyakarta		1	58		59		1	58		59
Jawa Timur		13	323		336		13	413		426
Bali	1		11		12	1		11		12
Timor-Timur		3			3		3			3
Kalimantan Barat			20		20			21		21
Kalimantan Selatan			7		7			7		7
Kalimantan Timur		5	7		12		5	7		12
Sulawesi Utara							1	3		4
Sulawesi Tengah			2		2			2		2
Sulawesi Selatan		2	5		7		2	5		7
Irian Jaya								1		1
Indonesia	7	63	956		1026	7	73	1073	1	1154

Notes: ^(a) Breeder. (Layer: with more than 2 500 head; broiler: turns off more than 19 500 head per year). Provinces with no large poultry farms are omitted from the table. ^(b) Govt indicates government Source: CASER (pers. comm.)

The majority of the households engaged in producing layers and/or broilers were on Java in both years. Although the information is somewhat sketchy, it seems likely that most large poultry farms in Indonesia are under individual ownership. They are mainly found on Java (Table 23). There are some government operated large farms and also some that are owned by public companies. Again these are concentrated in the provinces that are the most heavily populated.

DUCKS

Ducks play an important role in Indonesia's agricultural sector. According to information from the agricultural census, there were about 285 000 households with ducks in 1993 (Table 24).

Table 24. Number of households with ducks, 1963, 1973, 1983 and 1993

Provinces	1963 ^(a)	1973	1983	1993 ^(b)
DI Aceh	240 575	124 520	53 388	19 000
Sumatera Utara	625 132	89 697	7 739	12 000
Sumatera Barat	233 188	63 793	7 819	9 000
Riau	130 005	19 619	2 023	3 000
Jambi	60 797	15 498	3 792	3 000
Sumatera Selatan	541 225	64 325	13 106	12 000
Bengkulu	0	7 982	2 081	1 000
Lampung	0	33 321	4 307	8 000
DKI Jakarta	15 740	5 232	294	0
Jawa Barat	1 584 465	322 868	51 136	57 000
Jawa Tengah	2 075 295	298 051	37 405	46 000
DI Yogyakarta	244 957	26 684	4 468	6 000
Jawa Timur	2 528 295	257 298	37 009	44 000
Bali	237 776	33 295	4 948	4 000
Nusa Tenggara Barat	191 605	32 535	7 672	5 000
Nusa Tenggara Timur	236 972	5 201	620	0
Timor-Timur	0	0	134	0
Kalimantan Barat	197 438	21 515	2 231	3 000
Kalimantan Tengah	56 314	4 193	1 961	2 000
Kalimantan Selatan	132 168	27 434	13 554	17 000
Kalimantan Timur	47 579	3 054	1 867	2 000
Sulawesi Utara	200 493	7 169	698	1 000
Sulawesi Tengah	0	7 229	1 619	1 000
Sulawesi Selatan	409 906	156 400	27 020	27 000
Sulawesi Tenggara	0	4 358	1 074	1 000
Maluku	0	2 380	529	1 000
Irian Jaya	0	0	292	1 000
Indonesia		1 633 651	289 056	285 000

Notes: ^(a)Poultry household; ^(b)Preliminary figure

Source: Direktorat Jenderal Peternakan (1996), p.59

As well as providing income and food to farmers, ducks help control insects and weeds in irrigated rice lands. Research from West Java reported by Nari (1992) indicated that for a 1 ha plot, allocating 0.8 ha to rice, 0.1 ha to rice-fish and 0.1 ha to ducks would double net returns over the traditional rice-rice-fallow practice. The decline in the number of households with ducks, evident from Table 24, could therefore be viewed as an undesirable development from an ecological viewpoint as well as from a financial viewpoint. Table 25 provides a breakdown of the number of ducks in each of the provinces as well as the increase in their numbers between 1985 and 1997. It is apparent that in most provinces, the changes in numbers were small relative to the changes that occurred for chickens. Overall duck numbers were about 31 percent higher in 1997 than in 1985.

Table 25. Duck population 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	%	
DI Aceh	2 788	2 436	2 534	2 682	2 709	2 803	3 137	3 226	3 412	10.94	1.22
Sumatera Utara	1 343	1 202	1 266	1 391	1 721	2 009	2 155	2 155	2 365	7.59	1.76
Sumatera Barat	1 261	1 558	1 626	1 692	1 703	1 504	1 659	1 659	1 659	5.32	1.32
Riau	317	337	333	320	236	242	257	266	277	0.89	0.87
Jambi	197	311	340	384	410	439	424	410	538	1.73	2.73
Sumatera Selatan	830	1 113	1 180	1 430	1 502	1 524	1 473	1 511	1 600	5.13	1.93
Bengkulu	471	650	650	650	651	651	652	661	671	2.15	1.43
Lampung	336	409	423	410	430	437	499	504	508	1.63	1.51
DKI Jakarta	13	24	24	9	10	18	16	22	21	0.07	1.62
Jawa Barat	2 598	3 019	3 068	3 407	3 886	3 703	3 888	3 904	3 925	12.59	1.51
Jawa Tengah	2 792	3 090	3 184	3 425	3 521	3 575	3 756	3 768	3 781	12.13	1.35
DI Yogyakarta	236	249	249	218	219	227	232	232	233	0.75	0.99
Jawa Timur	2 118	2 020	2 140	2 140	2 152	2 421	3 166	2 868	2 986	9.58	1.41
Bali	710	704	654	561	616	647	672	680	698	2.24	0.98
Nusa Tenggara Barat	502	566	698	577	536	546	556	575	601	1.93	1.20
Nusa Tenggara Timur	91	288	297	95	278	187	212	163	161	0.52	1.77
Timor-Timur	29	205	272	299	289	362	28	28	29	0.09	0.98
Kalimantan Barat	325	597	723	682	753	334	374	369	409	1.31	1.26
Kalimantan Tengah	219	2 214	2 420	0	534	183	210	206	202	0.65	0.92
Kalimantan Selatan	2 105	692	701	845	568	2 652	2 694	3 116	3 334	10.70	1.58
Kalimantan Timur	250	1 385	1 656	1 449	1 342	243	268	316	320	1.03	1.28
Sulawesi Utara	246	690	744	976	1 180	377	394	412	430	1.38	1.75
Sulawesi Tengah	98	1	1	5	7	161	185	150	152	0.49	1.55
Sulawesi Selatan	3 777	189	213	2 924	1 650	2 244	2 297	2 299	2 322	7.45	0.61
Sulawesi Tenggara	145	0	0	0	0	218	238	261	275	0.88	1.89
		0									
Maluku	22	568	674	580	514	77	83	98	161	0.52	7.33
Irian Jaya	53	762	610	614	600	87	91	101	106	0.34	1.99
Indonesia	23 871	326 612	407 908	459 097	528 159	27 536	29 616	29 959	31 177	100.0	1.31

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.99 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.88 for 1985 to 1994 data

THE CATTLE INDUSTRY

Beef and buffalo

Winrock International Institute for Agricultural Development (1986) pointed out that with the exception of a few large government run and privately run cattle/buffalo farms, almost all of the draught and beef cattle are kept by smallholders. Their view was that in this situation animals are well integrated into the economic structure of the farm and village life. Although the Winrock report was produced over a decade ago, the beef industry is still mainly in the hands of smallholders. Most cattle are found in the provinces of Java, Madura, Bali and Lombok where the population density is high. The smallholders use few cash inputs in

rearing the animals, and labour supplied usually by the farmer or some other family member is the major input. The labour requirements vary depending on how the cattle are managed. Many smallholders leave the cattle in pens and bring feed to them. This confinement management is referred to as “cut and carry”. As this name implies, grass is cut by the farmer or by labourers and carried to stalls or yards where the animal is held. Other smallholders tether their animals in grazing areas during the day and confine them at night. In still other cases, children or older people may herd the animals during the day. In some areas, cattle are permitted to run free in designated areas during the cropping season and are permitted to graze crop residues during the dry season. Since recycling of crop residues is an important function of cattle, keeping them tethered makes it easier for manure to be collected. Allowing the cattle free range requires close supervision to maintain the security of the animals.

Table 26 shows the number of beef cattle raising households while Table 27 shows the number of beef cattle from 1985 to 1997 in each of the provinces. The number of households remained almost unchanged for the country as a whole although there have been some fairly dramatic changes when the data for individual provinces are examined. For example, the government statistics showed Lampung and Bengkulu had no beef cattle raising households in 1963, but by 1993, Lampung had 125 000 and Bengkulu had 13 000. Similar changes occurred to the provinces in Sulawesi

The change in the numbers of beef cattle in Indonesia between 1985 and 1997, while large, was nothing like the magnitude of the changes in the poultry numbers. The government statistics indicate that cattle numbers increased from 9 110 000 to 12 149 000 or by about 33 percent between 1985 and 1997. Lampung, Jambi, Irian Jaya and Kalimantan Timur had the largest relative increase in beef cattle numbers between 1985 and 1997. In each of these provinces, cattle numbers at least tripled. The highest beef cattle populations in 1997 were in Jawa Tengah (Central Java) and Jawa Timur (East Java). These were two of the provinces that had the highest numbers of cattle at the start of this decade as well (Figure 10).

The Indonesian government nominated seven provinces (Jawa Timur, Jawa Tengah, Yogyakarta, Lampung, Sumatera Selatan, Sumatera Barat and Nusa Tenggara Barat) for its cattle intensification programme (INSAPP) in 1997-1998. The objective of this programme was to increase the beef cattle population by natural increase of 318 340. Under the programme, semen from pure breed bulls was to be distributed to farmers. The programme was to be extended to other provinces in following years. At the time of writing, it was not clear whether the programme was to be shelved.

Table 26. Number of beef cattle households 1963, 1973, 1983 and 1993

Provinces	1963	1973	1983 ^(a)	1993 ^(b)
DI Aceh	57 921	70 873	39 366	75 000
Sumatera Utara	39 852	41 414	37 184	50 000
Sumatera Barat	94 700	99 233	49 918	63 000
Riau	5 304	5 535	8 173	24 000
Jambi	8 525	8 843	13 535	17 000
Sumatera Selatan	53 783	41 364	40 627	65 000
Bengkulu	0	6 299	4 446	13 000
Lampung	0	52 614	50 040	125 000
DKI Jakarta	560	821	1 302	0
Jawa Barat	59 097	67 321	57 622	53 000
Jawa Tengah	578 127	563 177	412 957	473 000
DI Yogyakarta	98 813	120 240	66 843	95 000
Jawa Timur	1 311 646	1 301 426	1 078 578	1 180 000
Bali	169 486	189 774	100 227	127 000
Nusa Tenggara Barat	66 766	82 024	79 237	107 000
Nusa Tenggara Timur	81 676	66 393	70 649	79 000
Timor-Timur	0	0	7 159	20 000
Kalimantan Barat	12 020	18 028	21 840	38 000
Kalimantan Tengah	3 334	4 314	3 647	7 000
Kalimantan Selatan	4 509	8 035	13 237	26 000
Kalimantan Timur	1 716	1 009	3 133	12 000
Sulawesi Utara	65 101	61 439	53 298	57 000
Sulawesi Tengah	0	42 481	42 640	44 000
Sulawesi Selatan	46 695	118 921	179 292	164 000
Sulawesi Tenggara	0	2 346	13 735	32 000
Maluku	0	6 249	6 827	16 000
Irian Jaya	0	0	7 159	20 000
Indonesia	2 759 631	2 980 220	2 458 164	2 976 000

Notes: ^(a) beef cattle and dairy cattle; ^(b) preliminary figures

Source: Direktorat Jenderal Peternakan (1996), p.50

Table 27. Beef cattle numbers by province, 1985 to 1997

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	384	392	398	515	531	558	599	635	703	5.79	1.83
Sumatera Utara	162	200	207	214	172	231	251	259	268	2.21	1.65
Sumatera Barat	333	369	376	384	392	390	411	414	418	3.44	1.26
Riau	49	99	106	109	110	115	121	129	139	1.14	2.84
Jambi	41	88	110	104	113	123	133	143	149	1.23	3.63
Sumatera Selatan	285	347	358	422	441	446	448	516	522	4.29	1.83
Bengkulu	73	92	93	95	96	94	93	94	94	0.77	1.29
Lampung	119	252	267	269	426	477	462	522	585	4.82	4.92
Jawa Barat	150	157	157	182	184	187	196	215	219	1.80	1.46
Jawa Tengah	1 083	1 162	1 191	1 184	1 193	1 249	1 253	1 260	1 267	10.43	1.17
DI Yogyakarta	184	190	190	191	191	193	196	197	197	1.62	1.07
Jawa Timur	2 791	3 005	3 062	3 157	3 163	3 328	3 302	3 339	3 383	27.84	1.21
Bali	424	456	436	472	484	500	514	528	544	4.47	1.28
Nusa Tenggara Barat	300	368	346	409	413	423	433	450	477	3.93	1.59
Nusa Tenggara Timur	585	659	676	749	767	786	785	717	717	5.90	1.23
Timor-Timur	50	68	77	85	93	122	124	137	151	1.24	3.02
Kalimantan Barat	87	108	117	132	142	148	150	154	169	1.39	1.94
Kalimantan Tengah	46	47	50	51	47	48	48	48	49	0.40	1.07
Kalimantan Selatan	75	120	130	129	134	148	159	167	170	1.40	2.27
Kalimantan Timur	20	56	71	67	74	76	81	83	88	0.72	4.40
Sulawesi Utara	209	246	253	260	264	265	272	283	285	2.35	1.36
Sulawesi Tengah	305	348	358	368	379	271	273	250	252	2.07	0.83
Sulawesi Selatan	1 176	1 218	1 226	1 236	643	785	806	828	841	6.92	0.72
Sulawesi Tenggara	106	244	285	290	233	249	265	277	285	2.35	2.69
Maluku	55	77	83	87	90	94	98	105	107	0.88	1.95
Irian Jaya	22	40	46	51	55	57	63	65	70	0.57	3.18
Indonesia	9 111	10 410	10 667	11 211	10 929	11 368	11 534	11 816	12 149	100	1.33

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.89 for 1990 to 1997 data; Direktorat Jenderal Peternakan (1988), p.3 for 1985 data.

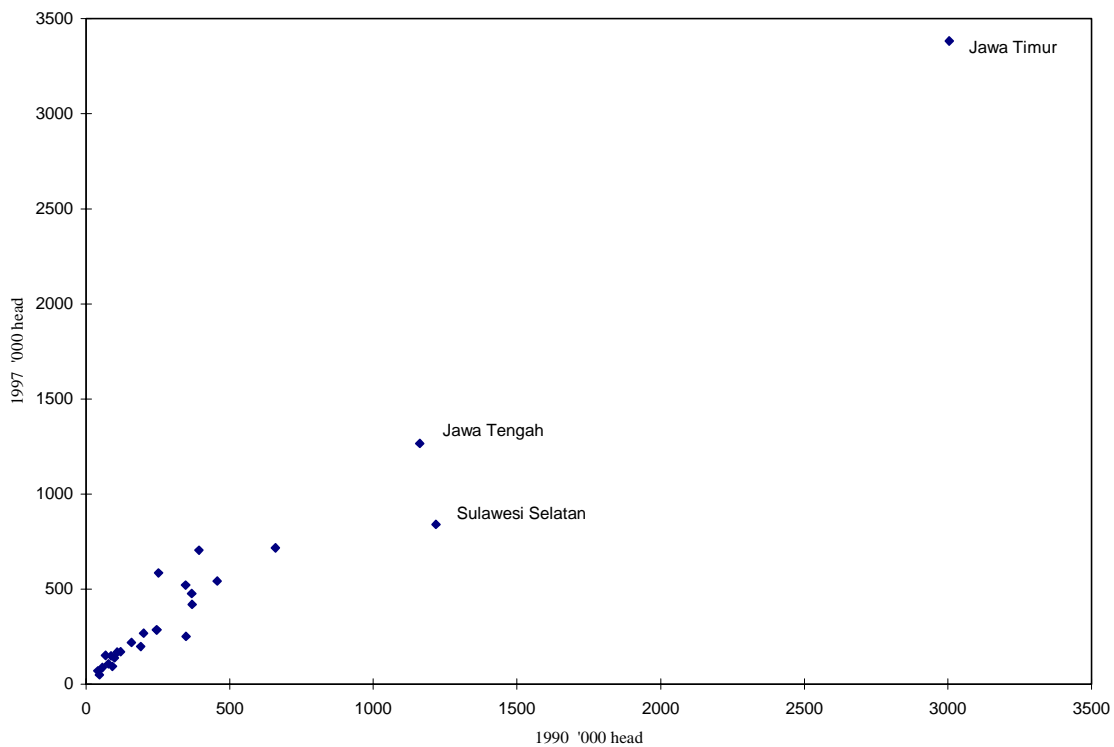


Figure 10. Beef cattle numbers in 1990 and 1997 in each of Indonesia's provinces

Despite an increase in cattle numbers of around 27 percent, Indonesia managed to increase production of beef by just under 50 percent between 1985 and 1995 (Table 28). The increase in cattle numbers came about through natural increase and also through imports of live cattle. Indonesia has been importing cattle from Australia since the 1970s. The breeds are primarily *Bos indicus* and *Bos taurus*. The purebred *Bos indicus* have been imported for mating. Specialized beef producers supplying the Jakarta market also use a Friesian breed called the “Grati”.

The data in Table 27 on cattle numbers and the data in Table 28 on production when considered together indicate an improvement in productivity between 1985 and 1995. This is shown by the percentage increase in production being greater than the percentage increase in numbers. However, examination of the data for each of the provinces shows the change in cattle numbers was not always related to the change in production. For example, cattle numbers in Kalimantan Timur in 1995 were over four times their 1985 level, but production was only 50 percent higher. On the other hand, cattle numbers in Jawa Barat increased by about 31 percent and production increased by over double this – by 64 percent. The situation in Jawa Tengah was similar. Cattle numbers increased by about 16 percent and production by 39 percent. These differences could be due to any of a number of factors, including agronomic characteristics of the regions, managerial ability of the farmer, the quality of the animals or differences in the cattle cycle between the regions.

Table 28. Beef meat production 1985 to 1994, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	4.8	5.73	6.13	5.62	5.53	5.91	4.77	5.22	5.23	1.40	1.09
Sumatera Utara	3.73	3.37	3.48	4.57	4.37	6.19	7.58	9.60	9.93	2.67	2.66
Sumatera Barat	5.8	6.23	6.52	7.77	8.73	9.6	9.39	9.43	9.54	2.56	1.65
Riau	0.7	1.24	1.39	1.42	1.36	2.12	2.18	3.19	3.45	0.93	4.93
Jambi	0.63	1.52	1.76	1.68	2.19	2.26	2.26	2.35	2.44	0.66	3.87
Sumatera Selatan	6.1	7.69	8.19	8.03	11.45	10.78	10.61	11.35	11.87	3.19	1.95
Bengkulu	0.32	0.48	0.57	0.72	0.73	0.76	0.91	1.16	1.17	0.31	3.65
Lampung	2.42	4.22	4.22	5.39	3.86	3.71	3.95	4.36	4.93	1.32	2.04
DKI Jakarta	33.65	34.52	34.52	53.81	53.98	53.98	35.51	42.23	42.77	11.49	1.27
Jawa Barat	29.43	35.81	35.24	35.93	68.57	43.18	46.90	56.07	67.47	18.13	2.29
Jawa Tengah	26.06	28.44	29.06	30.66	33.74	40.94	36.17	39.75	43.69	11.74	1.68
DI Yogyakarta	4.02	4.45	4.4	4.85	5.27	5.33	5.13	4.61	4.64	1.25	1.15
Jawa Timur	66.97	71.28	78.94	81.46	85.27	94.91	89.42	95.61	102.02	27.41	1.52
Bali	12.75	11.54	10.15	10.31	10.19	7.5	6.93	6.84	6.84	1.84	0.54
Nusa Tenggara Barat	3.35	5.19	2.98	5.47	5.48	6.18	4.00	5.72	5.88	1.58	1.76
Nusa Tenggara Timur	1.43	4.47	1.74	3.11	3.54	4.06	4.69	4.43	4.19	1.13	2.93
Timor-Timur	0.49	0.71	0.8	0.81	0.91	0.73	0.92	1.02	1.12	0.30	2.28
Kalimantan Barat	2.18	2.94	2.94	3.95	4.92	2.78	3.17	3.13	3.27	0.88	1.50
Kalimantan Tengah	1.01	1.39	0.08	1.42	1.75	1.52	1.35	1.97	2.03	0.54	2.01
Kalimantan Selatan	2.27	3.42	3.42	3.05	3.38	3.29	3.46	4.06	3.48	0.93	1.53
Kalimantan Timur	4.4	5.02	4.86	5.17	5.67	6.38	6.60	6.76	6.88	1.85	1.56
Sulawesi Utara	1.65	1.36	1.36	4.37	5.55	5.36	5.39	5.42	5.53	1.49	3.35
Sulawesi Tengah	2.13	2.92	3.04	3.24	3.46	3.51	3.91	3.95	4.01	1.08	1.88
Sulawesi Selatan	8.51	9.87	9.91	10.36	10.37	9.73	9.99	10.25	10.52	2.83	1.24
Sulawesi Tenggara	1.06	2.64	3.47	1	3.17	3.17	3.31	3.96	4.11	1.10	3.87
Maluku	0.84	1.7	1.96	1.78	1.79	1.63	1.65	2.19	2.21	0.59	2.63
Irian Jaya	0.7	1.07	1.06	1.06	1.05	0.95	1.82	2.60	2.96	0.80	4.23
Indonesia	227.4	259.22	262.19	297.01	346.28	336.46	311.97	347.20	372.16	100.0	1.64

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.104 for 1994 to 1997 data; Direktorat Jenderal Peternakan (1996), p.92 for 1990 to 1993 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data.

Buffalo

Bovine meat also comes from the indigenous cattle and the swamp buffalo. Both of these are small slow-growing animals (Winrock International Institute for Agricultural Development, 1986). The age of first calving is late in comparison to temperate animals and calving intervals range from 18 to 24 months.

There are three major breeds of cattle used for draught and beef. These are Ongole, Bali and Madura. The Aceh, a less well-known breed, is found in the Aceh province. Swamp buffalo are also used for draught power and beef in lowland areas and the Central Sumatra uplands.

The breeds of cattle are shown in Table 29. These data are for 1984 because more up-to-date data were not available.

Table 29. Breeds of cattle in Indonesia, 1984

Breed	Number
Ongole	4 400 000
Bali	1 000 000
Madura	300 000
Aceh, North Sumatra	400 000
Grati	80 000

Source: Winrock International Institute for Agricultural Development (1986).

The number of households with buffalo fell by over 50 percent between 1963 and 1993. The falls were not uniform across Indonesia. On Java island, in each of the provinces, the number of households with buffalo fell by between 79 percent (Jawa Tengah and DI Yogyakarta) and 65 percent (Jawa Timur). Going against this trend, in some other provinces the number of households with buffalo increased. For example, in Riau on Sumatra, the number of households with buffalo in 1993 was 44 percent higher than in 1963 while in each of the four provinces on Kalimantan the number of households with buffalo showed increases of between 97 percent and 660 percent. For most of the households with buffalo, the main use of the buffalo would be as a draught animal. Table 30 shows how the number of households with buffalo changed between 1963 and 1993.

Table 30. Number of households with buffalo 1963, 1973, 1983 and 1993

Province	1963	1973	1983	1993 ^(a)
DI Aceh	55 942	67 755	45 474	37 000
Sumatera Utara	32 756	43 348	31 606	37 000
Sumatera Barat	31 717	48 848	23 666	28 000
Riau	5 563	6 369	7 051	8 000
Jambi	10 260	13 191	11 741	12 000
Sumatera Selatan	39 477	15 351	10 474	10 000
Bengkulu	0	11 633	5 879	7 000
Lampung	0	12 526	8 385	13 000
DKI Jakarta	3 170	2 330	410	0
Jawa Barat	274 613	248 572	122 991	92 000
Jawa Tengah	253 904	173 812	99 353	54 000
DI Yogyakarta	14 604	10 854	5 191	3 000
Jawa Timur	112 391	79 721	52 838	39 000
Bali	4 484	5 276	1 979	2 000
Nusa Tenggara Barat	40 301	43 478	39 073	38 000
Nusa Tenggara Timur	42 139	39 810	27 534	26 000
Timor-Timur	0	0	6 134	10 000
Kalimantan Barat	362	164	238	1 000
Kalimantan Tengah	507	340	502	1 000
Kalimantan Selatan	1 298	2 015	2 546	4 000
Kalimantan Timur	526	4 330	1 195	4 000
Sulawesi Utara	3 863	360	199	0
Sulawesi Tengah	0	2 909	2 294	2 000
Sulawesi Selatan	94 978	113 880	84 311	57 000
Sulawesi Tenggara	0	2 922	1 919	1 000
Maluku	0	600	834	3 000
Irian Jaya	0	0	113	0
Indonesia	1 022 855	950 394	593 930	489 000

Notes: ^(a) preliminary figures

Source: Direktorat Jenderal Peternakan (1996), p.52.

Table 31. Buffalo population 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	434	362	367	383	393	409	421	430	454	14.01	1.05
Sumatera Utara	180	207	212	223	229	237	248	256	265	8.19	1.47
Sumatera Barat	167	194	201	206	209	196	205	216	228	7.03	1.36
Riau	37	40	42	42	43	44	45	50	55	1.71	1.49
Jambi	49	65	69	71	74	77	81	86	87	2.69	1.77
Sumatera Selatan	122	134	138	137	140	136	128	150	152	4.68	1.24
Bengkulu	79	94	95	96	97	91	86	87	88	2.72	1.11
Lampung	38	33	34	35	44	45	48	51	54	1.65	1.41
DKI Jakarta	2	1	1	1	1	1	1	0	1	0.02	0.25
Jawa Barat	470	501	506	525	529	522	501	491	487	15.04	1.04
Jawa Tengah	325	287	282	278	265	265	256	244	232	7.16	0.71
DI Yogyakarta	14	15	14	11	11	10	10	9	9	0.28	0.64
Jawa Timur	221	184	177	171	166	158	156	160	168	5.20	0.76
Bali	8	10	11	10	11	11	11	11	11	0.35	1.43
Nusa Tenggara Barat	221	227	234	212	215	214	214	220	227	7.01	1.03
Nusa Tenggara Timur	174	175	176	184	182	165	191	165	167	5.16	0.96
Timor-Timur	35	45	48	50	53	70	65	69	74	2.28	2.11
Kalimantan Barat	2	6	7	6	6	6	7	7	8	0.25	4.01
Kalimantan Tengah	8	9	9	9	9	9	9	12	12	0.38	1.54
Kalimantan Selatan	48	48	49	49	47	47	47	48	49	1.50	1.02
Kalimantan Timur	15	18	24	21	21	22	23	23	24	0.74	1.60
Sulawesi Utara	3	5	5	5	5	1	0	0	0	0.01	0.06
Sulawesi Tengah	32	38	38	40	42	14	14	10	10	0.30	0.31
Sulawesi Selatan	529	530	535	540	231	321	336	341	342	10.57	0.65
Sulawesi Tenggara	13	15	16	14	12	12	12	11	11	0.34	0.85
Maluku	20	21	21	21	21	21	22	22	23	0.71	1.15
Irian Jaya	0	1	1	1	1	1	1	1	1	0.03	nc
Indonesia	3 245	3 335	3 311	3 342	3 057	3 104	3 136	3 171	3 238	100.00	1.00

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.91 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.80 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.3 for 1985 data.

Table 32. Buffalo meat production 1985 to 1994, by province

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	1.48	2.25	2.83	2.89	2.82	1.81	3.10	2.89	3.17	6.14	2.14
Sumatera Utara	4.18	4.68	4.66	6.11	6.12	6.73	8.21	9.13	9.44	18.30	2.26
Sumatera Barat	3.36	2.74	2.78	3.25	4.01	3.62	3.85	3.85	4.24	8.22	1.26
Riau	1.92	1.87	1.92	0.82	2.23	2.11	2.13	2.29	2.42	4.69	1.26
Jambi	1.18	1.24	1.25	1.52	1.67	1.56	1.79	1.73	1.81	3.50	1.53
Sumatera Selatan	1.86	1.95	2.08	2.17	2.42	2.31	2.17	2.14	2.20	4.26	1.18
Bengkulu	1.08	0.61	0.63	1.24	1.26	1.14	1.73	1.01	1.02	1.97	0.94
Lampung	0.86	0.47	0.47	0.41	0.4	0.39	0.40	0.24	0.25	0.49	0.29
DKI Jakarta	4.36	3.16	3.16	3.63	4.54	4.54	1.17	1.57	1.60	3.10	0.37
Jawa Barat	13.24	11.05	13.43	9.22	12	9.66	8.37	8.66	9.24	17.91	0.70
Jawa Tengah	6.72	5.58	6.27	4.92	5.08	5.18	4.93	4.93	4.70	9.11	0.70
DI Yogyakarta	0.13	0.07	0.05	0.06	0.05	0.06	0.05	0.05	0.05	0.09	0.35
Jawa Timur	0.67	0.56	0.55	0.32	0.27	0.4	0.33	0.33	0.21	0.41	0.32
Bali	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.30
Nusa Tenggara Barat	1.42	0.85	0.4	1.03	1.03	1.56	1.16	1.54	1.83	3.55	1.29
Nusa Tenggara Timur	0.31	0.19	0.11	0.11	0.17	0.17	0.17	0.23	0.23	0.44	0.74
Timor-Timur	0.24	0.32	0.33	0.35	0.38	0.33	0.36	0.36	0.36	0.70	1.51
Kalimantan Tengah	0.01	0.04	0.06	0.03	0.05	0.05	0.06	0.07	0.05	0.10	5.30
Kalimantan Selatan	0.5	0.57	0.57	0.57	0.47	0.37	0.53	0.55	0.66	1.28	1.32
Kalimantan Timur	0.5	0.5	0.23	0.35	0.13	0.27	0.29	0.41	0.71	1.37	1.41
Sulawesi Tengah	0.01	0	0.1	0.1	0.1	0.26	0.02	0.02	0.02	0.04	2.30
Sulawesi Selatan	4.4	5.46	5.58	5.75	5.79	5.44	6.48	6.48	7.07	13.71	1.61
Sulawesi Tenggara	0.14	0.11	0.14	0.18	0.16	0.2	0.16	0.16	0.17	0.32	1.18
Maluku	0.01	0	0	0.05	0.02	0.01	0.02	0.02	0.03	0.06	2.90
Indonesia	48.6	44.29	47.53	45.09	51.23	48.2	47.50	48.66	51.59	100.0	1.06

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.105 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.93 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data

The dairy industry

The dairy industry began in Indonesia in the nineteenth century at the instigation of the Dutch authorities. The industry, which was concentrated on Java, catered mainly for the Dutch expatriates who lived in Indonesia. After the Dutch were forced out of Indonesia in 1945, Indonesian farmers took over the industry. For the Indonesians, the main reason for keeping dairy cattle was the production of manure. Gradually this purpose changed to produce milk (INI ANSREDEF, 1995).

Dairy co-operatives have been an important part of the industry because the industry is based on smallholders organized into co-operatives. The first co-operative was established in Pengalengan, near Bandung in West Java in 1948. Later, co-operatives were established in Pujon (near Malang in East Java), in Pasuran (Grati in East Java), and in Boyali and Ungaran in Central Java. During the 1960s, many co-operatives went bankrupt, so that by 1978 only

two co-operatives had managed to survive. These were Pengalengan⁵ and SAE in Pujon (INI ANSREDEF, 1995). The third Five-year Development Plan (1979 to 1983) was a key period for the industry. A dairy co-operative organization known as BKCSI (the Indonesian Dairy Co-operative Board) was established in July 1978. This body lasted only one year, being replaced by the GKSI (Union of Dairy Co-operatives of Indonesia, or Gabungan Koperasi Susu Indonesia). This is a secondary co-operative, whose members are the chairmen of the primary (or farmer level) co-operatives (GKSI, 1996). The GKSI still plays an important part in the industry because it is involved in the setting of the mixing ratio, a policy measure that will be discussed later in this report.

Table 33 shows the distribution of dairy households by province. It is obvious that Java is where the industry is concentrated. In 1993 about 96 percent of the households with dairy cattle were on Java while 3.3 percent were on Sumatera. In 1991, the government began allocating imported dairy cattle to provinces with small numbers of milking cows in an effort to diversify the industry away from its Java base. The programme seems to have had little success because the milk processing industry is so well established in Java (PT Corinthian Infopharma Corpora, 1995).

⁵ Pengalengan is the largest dairy co-operative in Indonesia in terms of number of members. In 1996, there were about 12 000 member farmers.

Table 33. Number of dairy cattle households 1963, 1973, 1983 and 1993^(a)

Provinces	1963	1973	1983	1993 ^(b)
DI Aceh	1 399	151	0	0
Sumatera Utara	4 039	932	6 600	1 000
Sumatera Barat	2 099	588	476	0
Riau	145	17	0	0
Jambi	650	56	0	0
Sumatera Selatan	3 435	230	0	0
Bengkulu	0	97	541	0
Lampung	0	308	0	0
DKI Jakarta	1 390	1 530	458	0
Jawa Barat	5 684	2 893	11 534	26 000
Jawa Tengah	16 716	12 294	21 894	31 000
DI Yogyakarta	1 905	846	1 436	1 000
Jawa Timur	12 391	10 519	25 748	39 000
Bali	583	131	335	0
Nusa Tenggara Barat	383	208	0	0
Nusa Tenggara Timur	3 628	80	0	0
Kalimantan Barat	672	82	327	0
Kalimantan Selatan	327	0	0	0
Sulawesi Utara	623	171	0	0
Sulawesi Selatan	621	245	0	0
Irian Jaya	0	0	247	0
Indonesia	56 600	31 438	64 663	98 000

Notes: ^(a) Provinces that did not have dairy cattle in any of the years are excluded from the table

^(b) Preliminary figures

Source: Direktorat Jenderal Peternakan (1996), p.51.

The dairy industry development was most rapid in Repeleta III. The government noticed the widening gap between consumption and production during the 1970s when local production met only about 5 percent of sales. The government also saw the industry as a potential source of income to many poor rural communities and so it set developmental and production targets subsidized with government funding. It is apparent from Table 34 that almost all the expansion in dairy cattle numbers between 1985 and 1997 occurred on Java. Dairy cattle numbers more than doubled in Jawa Barat (West Java) and in Jawa Tengah (Central Java).

Table 34. Dairy cattle population 1985 to 1995, by province^(a)

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(b)		1997/1985
	(no.)	(no.)	(no.)	(no.)	(no.)	(no.)	(no.)	(no.)	(no.)	(%)	
DI Aceh	0	0	0	354	46	46	151	153	181	0.05	nc
Sumatera Utara	6 368	7 233	7 428	7 625	7 833	7 920	7 935	8 362	8 811	2.49	1.38
Sumatera Barat	1 968	2 314	2 393	2 331	1 821	992	997	934	944	0.27	0.48
Jambi	18	32	32	32	0	40	23	23	23	0.01	1.28
Sumatera Selatan	50	159	173	182	166	154	145	145	174	0.05	3.48
Bengkulu	149	104	119	125	131	52	54	0	0	0.00	0.00
Lampung	75	146	150	160	34	69	58	39	40	0.01	0.53
DKI Jakarta	5 156	5 811	5 881	5 537	5 342	4 796	4 653	4 312	4 300	1.22	0.83
Jawa Barat	49 666	104 580	107 087	108 218	113 803	114 681	118 753	119 744	121 262	34.33	2.44
Jawa Tengah	41 251	75 279	78 844	81 647	90 993	94 457	97 035	97 520	98 007	27.75	2.38
DI Yogyakarta	3 470	3 761	2 876	2 924	2 924	2 766	2 791	2 744	2 900	0.82	0.84
Jawa Timur	66 278	93 769	100 524	102 235	105 657	107 216	108 299	113 554	116 064	32.86	1.75
Bali	131	119	90	87	89	86	75	78	78	0.02	0.60
Timor-Timur	0	0	34	41	0	38	40	42	44	0.01	nc
										0.00	nc
Kalimantan Barat	785	152	157	179	188	198	51	54	70	0.02	0.09
Kalimantan Tengah	24	0	2	0	3	0	3	3	3	0.00	0.13
Kalimantan Selatan	0	55	84	74	69	82	92	98	103	0.03	nc
Kalimantan Timur	35	139	139	110	126	69	74	74	76	0.02	2.17
Sulawesi Utara	0	116	138	126	126	60	21	21	24	0.01	nc
Sulawesi Selatan	0	0	0	78	0	78	30	32	32	0.01	nc
Maluku	24	0	0	8	12	12	0	0	0	0.00	0.00
Irian Jaya	121	109	139	153	157	92	54	57	63	0.02	0.52
Indonesia	175 638	293 878	306 290	312 226	329 520	334 021	341 334	347 989	353 199	100.0	2.01

Notes: ^(a) Provinces that did not have dairy cattle in any of the years are excluded from the table ^(b) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.90 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.79 for 1990 to 1994; Direktorat Jenderal Peternakan (1988), p.3 for 1985.

Table 35 contains information on milk production. This more than doubled between 1985 and 1995, from 191 100 t to 432 940 t. Almost all of Indonesia's milk is produced on Java, with Jawa Barat (West Java) showing a four-fold increase between 1985 and 1995 to 223 300 t.

Table 35. Fresh milk production 1985 to 1997, by province^(a)

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(b)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.00	0.00	0.00	0.42	0.05	0.05	0.15	0.18	0.18	0.04	nc
Sumatera Utara	6.40	8.51	8.74	8.97	9.21	4.60	5.34	5.86	6.18	1.38	0.22
Sumatera Barat	2.00	2.72	2.81	2.74	2.14	1.00	1.01	0.94	0.95	0.21	0.11
Riau	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	nc
Jambi	0.00	0.04	0.04	0.04	0.00	0.01	0.00	0.01	0.01	0.00	nc
Sumatera Selatan	0.00	0.19	0.20	0.21	0.20	0.13	0.13	0.12	0.12	0.03	nc
Bengkulu	0.10	0.12	0.14	0.15	0.15	0.06	0.05	0.00	0.00	0.00	0.00
Lampung	0.00	0.17	0.18	0.19	0.04	0.02	0.02	0.02	0.02	0.00	nc
DKI Jakarta	5.40	6.83	6.92	6.51	6.28	7.70	6.25	5.87	5.87	1.31	0.24
Jawa Barat	55.50	122.99	125.93	127.26	133.83	215.64	223.30	225.17	226.55	50.74	0.91
Jawa Tengah	43.30	88.53	92.72	96.02	107.01	64.01	63.68	65.13	66.62	14.92	0.34
DI Yogyakarta	3.50	4.42	3.38	3.44	3.44	3.59	3.43	3.39	3.58	0.80	0.23
Jawa Timur	74.70	110.27	118.22	120.23	124.25	129.54	129.63	134.04	135.92	30.44	0.41
Bali	0.10	0.14	0.11	0.10	0.10	0.12	0.11	0.09	0.09	0.02	0.21
Timor-Timur	0.00	0.00	0.05	0.05	0.00	0.05	0.04	0.04	0.04	0.01	nc
Kalimantan Barat	0.80	0.18	0.18	0.21	0.22	0.02	0.06	0.06	0.08	0.02	0.02
Kalimantan Selatan	0.00	0.06	0.10	0.09	0.08	0.08	0.12	0.09	0.09	0.02	nc
Kalimantan Timur	0.00	0.16	0.16	0.13	0.15	0.07	0.08	0.09	0.09	0.02	nc
Sulawesi Utara	0.00	0.14	0.16	0.15	0.15	0.04	0.01	0.01	0.01	0.00	nc
Sulawesi Selatan	0.00	0.00	0.00	0.09	0.00	0.00	0.04	0.05	0.06	0.01	nc
Irian Jaya	0.10	0.13	0.16	0.17	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	191.9	345.60	360.20	367.18	387.52	426.73	433.44	441.16	446.48	100.0	0.52

Notes: ^(a) Provinces that did not produce milk in any of the years are excluded from the table ^(b) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.119 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.106 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.40 for 1985 data.

Dairy farms in Indonesia are small: on average they have between three and four dairy cattle per farm. According to industry sources, in 1994 there were only a dozen or so farms with over 100 milking cows, and only about 330 with between 10 and 100 cows. There are a number of reasons for the small size of dairy farms. First, land transfer laws and the co-operative structure make consolidation of small tracts of land into larger holdings very difficult. Second, the agricultural credit schemes that have been used in the industry are generally intended to assist smallholders to purchase a very small number of cattle. They are not designed to help larger farmers. Third, small farmers have limited resources and are basically subsistence farmers. Fourth, government policy has been geared towards the development of cash crops and before that food self-sufficiency. Dairy cattle were seen as only a supplementary source of income. Finally, few small farmers would themselves consume the milk produced on the farm. They would be more likely to use it to feed calves. Production per cow is not high, averaging about 1 100 L per year. Riethmuller and Smith (1995) found from a survey of Javanese farmers that some cows produce as little as 500-600 L per year. Farmers feed their cattle little concentrate and the grasses that are fed are sometimes of low nutritional content. The milk is often of poor quality with a high bacterial

content. Mastitis is frequently a problem because of poor milking practices. Farmers deliver milk to collection points located perhaps 1 km from the farm. The volume of the milk is measured; its specific gravity is tested to check it has not been watered down; and the employee of the co-operative collecting the milk carries out a taste test. The price that each farmer receives is the average for the co-operative, providing farmers with little or no incentive to improve milk quality. Prices can vary between co-operatives, depending on the quality of the milk the co-operative delivers to the processing plant.

One of the initial functions of the GKSI was to arrange imports of dairy cattle⁶. Between 1979 and 1983, just over 52 000 dairy cattle were imported from Australia and New Zealand. By 1993, about 85 000 dairy cattle had been imported. These cattle were distributed to farmer members of the primary multi-enterprise village co-operatives and KUD. The KUD or Koperasi Peternak Serap are village-based dairy co-operatives that collect milk and the sell it to the processors. Most of the imported cattle were assigned to eight provinces⁷. Besides importing cattle, the GKSI established four milk treatment plants and two feed mills.

Part of the rationale for the dairy industry is that it provides an opportunity for small farmers, many of whom do not own land, to accumulate assets. Doran *et al.* (1979) argue that such an approach is an accessible and reliable vehicle for such farmers to accumulate wealth. However, the ability of smallholders to raise cattle will be greatly influenced by the availability of labour, particularly family labour. As the opportunity cost of this family labour increases, the economic profit of cattle may decline or disappear. The increased availability of schooling reduces the amount of child labour. Adult labour may not be substitutable for child labour, as Kristanto (1982) points out, because in some parts of Indonesia the tending of animals is considered to be an inferior occupation for adult males⁸. This places an upper limit on the number of cattle that can be raised. A related problem with the use of children is that the extension programmes are directed mainly at males. Hence children may not be able to recognize disease or other production-related problems.

As is also the case with beef cattle and buffalo, it is common practice for dairy cattle to be tethered by the side of roads. In such cases, feed is cut and carried to them. Alternately, they may be herded to “waste” areas where they graze on crop residues. As mentioned already, feed supplements are rarely given in sufficient quantity, in the view of Kristanto (1982) and Smith and Riethmuller (1995). During the non-productive period, Kristanto (1982) believes it does not pay the farmer to give the animal supplementary feed. His view is that any increase in value may not offset the time the farmer has to allocate to gathering additional feed for the animal.

The dairy cattle population is made up almost exclusively of pure bred Friesian Holsteins. This dates back to the pre-independence days. Considering the large body size (over 500 kg) and the breed’s intolerance of heat and humidity, the dominance of Friesian Holsteins may be a source of inefficiency for the industry. On the positive side, a beef fattening industry has developed among smallholders using the Friesian Holstein bull calves produced from dairy

⁶ Imports took place before the GKSI was established. Hutabarat (1996) mentions that dairy cattle were imported in 1962 to meet milk demand for the Asian Games held that year in Jakarta. These were Holstein Friesian cattle imported from Denmark. Imports (also Holstein Friesians) in 1965 came from the Netherlands.

⁷ The provinces were Jakarta, West Java, Yogyakarta, Central Java, East Java, North Sumatera, West Sumatera and Bengkulu.

⁸Kristanto (1982) makes this point in relation to Buginese and Makassar society.

cows. These cattle have shown a hardiness and rapid rate of growth under typical smallholder confinement feeding systems. They produce a lean carcass and high yield that Javanese butchers are said to prefer. Other breeds such as Red Danish, Illawara Shorthorn and Australian Friesian Sahiwal have also been imported at different times, but apparently with limited success (INI ANSREDEF, 1995).

The Indonesian Government has been running an artificial insemination (AI) programme based mainly upon Friesian Holstein bulls. Semen is produced for the Director General of Livestock Services, or for the KUD to which the farmer belongs. In the past a large quantity of Friesian Holstein semen was imported from Australia, New Zealand, Japan and the USA. The Indonesian government, with technical assistance from the government of New Zealand, has established two bull studs: at Lembang in Central Java and at Singosari in East Java. Lembang has the semen from the Friesian Holstein bulls while Singosari has the semen from Bali, Ongole and Brahman cattle. Besides the use of AI, the government has continued to import cattle (mentioned earlier) and to assist the industry through credit programmes and through improving management. Information on the attributes of the bull providing semen is not available. This means it is impossible for farmers to improve specific attributes of their cattle through AI.

The small dairy herd in Java leaves little room for selection on the female side. All heifers must be kept as replacements. Winrock International Institute for Agricultural Development (1986) reported that no studies of replacement rates had been done at the time of their report. Culling is done because of loss of fertility or mastitis rather than loss of production. There is no systematic herd recording scheme in place.

Winrock International Institute for Agricultural Development reported that the genetic quality of the bulls used to produce the semen at Lembang was unknown and ten years later this still seems to be the case. As the Winrock team noted, there would seem to be considerable potential to improve production on the male side. It is assumed by many in the industry that imported Friesian Holstein bulls will have a positive effect on the industry because they are coming from countries where milk yields are higher. This may not be the case given the heritability of milk production – 25 percent.

Calf management practices are similar to other countries. Calves are navel dipped with iodine at birth and given colostrum by suckling for several days. Milk feeding is generally for three months and averages 2 L per day. Calves receive cut grass and a supplement of rice bran or concentrate. Bull calves are sold at birth or raised to weaning. Sometimes the dairy farmer will share fatten the calf through an arrangement with other farmers. This involves profit sharing and cost sharing.

The Busep or mixing ratios is a policy measure that is used to encourage the local industry⁹. Under this measure, domestic dairy processors are permitted to import material inputs (such as skimmed milk powder) only after they have absorbed all domestically produced milk. The ratio in the second half of 1997 was 1:1.7 (Table 36) which means that for every 1 L of domestic production that is absorbed, processors are permitted to import 1.7 L of milk (or milk equivalent). When first used in 1977, the ratio was 1:25, indicating that the local content was 4 percent. According to INI ANSREDEF (1995), Indonesia was planning to continue

⁹ The Busep is actually a certificate and it was introduced under the Joint Decree of the three ministers in July 1982.

with the mixing arrangements in the short term, replacing it by a tariff in 2003 as part of Indonesia's commitment to the WTO¹⁰. Only a limited number of firms (10 in 1995) are permitted to import milk but firms not permitted to import are permitted to buy Busep from firms that are allowed to import¹¹. Information on the price at which Busep have been traded is not made public. Riethmuller and Smith (1994) and Riethmuller *et al.* (1999) estimated the welfare losses from the policy to be of the order (at most) of A\$ 25-30 million per year. As a result of the IMF intervention in the economy, the Busep and other local content schemes were abolished on 1 February 1998.

¹⁰ It is difficult to obtain information on the future value of the mixing ratio. Some analysts indicated that its value would be 1:4.8 by 2000, while INI ANSREDEF (1995) wrote that the ration would not be "less than 1:1.6" (p.21).

¹¹ The registered importers are PT Food Specialities Indonesia, PT Indomilk, PT Friesche Vlag Indonesia, PT Foremost Indonesia, PT Ultra Jaya, PT Dafa, PT sari Husada, PT Mirota, Pt Nutricia Indonesia and PT Sugizindo. PT Panca Niaga is the registered importer of fresh raw milk for the non-milk-processing industry.

Table 36. Mixing ratio figures 1982-1997

Year	Semester	Mixing ratio	
		Domestic milk	Imported
1982	1	1	8
1982	2	1	7
1983	1	1	6
1983	2	1	5
1984	1	1	3.5
1984	2	1	3.5
1985	1	1	2
1985	2	1	2
1986	1	1	3.5
1986	2	1	3.5
1987	1	1	2
1987	2	1	2
1988	1	1	1.7
1988	2	1	0.7
1989	1	1	0.7
1989	2	1	0.7
1990	1	1	0.53
1990	2	1	0.75
1991	1	1	1
1991	2	1	2
1992	1	1	2
1992	2	1	2
1993	1	1	1.25
1993	2	1	1.6
1994	1	1	1.6
1994	2		2
1995	1	1	2.125
1995	2	1	2.9
1996	1	1	2.4
1997	1	1	1.7

Notes: The ratio is decided every six months in the meeting of the Dairy Coordinating Team

Consumption of dairy products in Indonesia is not high compared with western countries. The most popular product is sweetened condensed milk. This is consumed dissolved in boiled water. Fresh milk is expensive and is only consumed by the wealthy or expatriates because refrigeration is not common in Indonesia. Powdered milk is consumed mainly by children.

Later in this paper information on elasticities will be presented and dairy products will be shown to be income elastic. This means that during the next few years when Indonesia's economic growth is likely to be low, the demand for milk and dairy products is not likely to show much growth.

OTHER LIVESTOCK

Sheep, goats, pigs and rabbits are used for food in Indonesia. Information on these sources of animal protein is extremely difficult to obtain, other than the information on production and farm numbers that follows. These industries seem to play an important role in the nutrition of people in rural areas and they are a part of the traditional livestock sector.

Goats and sheep

Goats and sheep are important as an income source to smallholders. Adjid and Daniels (1992) report that despite low productivity, they contribute as much as 25 percent of the income earned by smallholders near to rubber plantations¹². Table 37 provides information on the number of households with goats from 1963 to 1993. It is clear from this table that the number of households with goats fell markedly over this period.

¹² Rubber production in Indonesia is mainly in the hands of small farmers.

Table 37. Number of households with goats 1963, 1973, 1983 and 1993

Provinces	1963	1973 ^(a)	1983 ^(a)	1993 ^(b)
DI Aceh	44 709	40 930	11 863	16 000
Sumatera Utara	79 790	48 365	27 513	23 000
Sumatera Barat	18 389	23 233	3 021	3 000
Riau	13 568	17 092	6 523	7 000
Jambi	13 604	13 811	7 099	4 000
Sumatera Selatan	110 326	23 443	9 524	10 000
Bengkulu	0	8 939	2 745	3 000
Lampung	0	58 707	16 800	30 000
DKI Jakarta	6 210	1 513	1 068	0
Jawa Barat	386 209	381 253	191 014	51 000
Jawa Tengah	838 414	1 076 591	147 751	90 000
DI Yogyakarta	113 010	152 676	10 544	7 000
Jawa Timur	813 600	874 098	101 724	78 000
Bali	5 819	7 668	1 662	4 000
Nusa Tenggara Barat	40 390	45 500	13 545	9 000
Nusa Tenggara Timur	71 705	72 480	17 512	19 000
Timor-Timur	0	0	3 847	9 000
Kalimantan Barat	7 210	7 435	2 391	2 000
Kalimantan Tengah	1 537	1 254	620	1 000
Kalimantan Selatan	4 011	2 317	2 115	2 000
Kalimantan Timur	1 964	5 240	1 623	1 000
Sulawesi Utara	30 169	12 175	3 637	2 000
Sulawesi Tengah	0	17 934	6 764	5 000
Sulawesi Selatan	44 964	74 868	14 430	9 000
Sulawesi Tenggara	0	10 499	1 930	2 000
Maluku	0	11 071	5 669	7 000
Irian Jaya	0	0	837	1 000
Indonesia	2 645 598	2 989 092	613 771	397 000

Notes: ^(a) Goat and sheep; ^(b) Preliminary figures

Source: Direktorat Jenderal Peternakan (1996), p.53.

Goat numbers in Indonesia increased by 39 percent between 1985 and 1995 (Table 38). About seven million goats were in Java, with the rest dispersed through the other provinces. Numbers increased in all provinces with the exception of Sulawesi Selatan and Jakarta

Table 38. Goat population 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	336	389	403	475	484	557	578	609	670	4.61	1.99
Sumatera Utara	306	466	490	515	541	586	649	714	785	5.40	2.57
Sumatera Barat	203	230	235	240	304	243	261	280	303	2.08	1.49
Riau	129	167	175	170	179	191	200	224	252	1.73	1.95
Jambi	57	86	93	98	101	112	115	119	123	0.84	2.15
Sumatera Selatan	401	471	500	508	528	545	549	523	541	3.72	1.35
Bengkulu	123	144	145	148	150	151	154	156	157	1.08	1.27
Lampung	198	303	312	317	329	737	722	734	747	5.14	3.77
DKI Jakarta	8	8	8	7	7	9	7	8	8	0.05	0.98
Jawa Barat	1160	1787	1819	1863	1902	1914	1957	2099	2112	14.52	1.82
Jawa Tengah	2486	2495	2467	2646	2562	2720	2831	2989	3156	21.70	1.27
DI Yogyakarta	257	270	270	274	274	274	276	277	278	1.91	1.08
Jawa Timur	1995	2109	2132	2245	1647	2266	2304	2549	2619	18.01	1.31
Bali	72	95	100	107	113	117	116	117	119	0.82	1.66
Nusa Tenggara Barat	256	271	286	252	267	287	301	322	348	2.39	1.36
Nusa Tenggara Timur	341	447	434	529	544	600	612	505	629	4.33	1.84
Timor-Timur	74	97	100	117	126	159	172	187	203	1.40	2.74
Kalimantan Barat	48	50	50	61	64	84	88	104	108	0.75	2.26
Kalimantan Tengah	19	14	16	20	17	20	22	23	23	0.16	1.19
Kalimantan Selatan	57	57	58	58	59	65	69	72	73	0.50	1.28
Kalimantan Timur	42	51	54	56	59	62	67	82	85	0.58	2.02
Sulawesi Utara	70	92	95	95	102	99	101	103	105	0.72	1.49
Sulawesi Tengah	169	235	249	265	120	194	206	197	212	1.46	1.26
Sulawesi Selatan	518	622	631	642	653	437	453	461	469	3.22	0.91
Sulawesi Tenggara	90	127	131	109	110	92	101	112	120	0.83	1.33
Maluku	163	172	176	187	192	201	212	232	251	1.73	1.54
Irian Jaya	21	43	55	60	65	48	45	43	46	0.32	2.20
Indonesia	9 599	11 298	11 484	12 062	11 502	12 770	13 167	13 840	14 540	100.00	1.51

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (pers. comm.) for 1995 data; Direktorat Jenderal Peternakan (1996), p.81 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.3 for 1985 data.

Government statistics indicate that goat meat production was 61 150 t, or about 18 percent of the meat output from the beef industry. It is quite likely that the contribution of goat meat is greater than this because of unrecorded slaughtering. The output of goat meat in 1995 was 24 percent above the level of ten years earlier, and Table 39 shows that it was quite variable between 1990 and 1995.

Table 39. Goat meat production 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	2.05	2.45	2.62	2.27	2.41	0.93	1.65	1.82	1.81	2.93	0.88
Sumatera Utara	4.7	2.16	2.09	2.74	2.79	1.7	2.09	3.34	3.68	5.96	0.78
Sumatera Barat	1.9	0.51	0.19	0.57	0.61	0.54	0.71	0.72	0.77	1.25	0.40
Riau	0.18	0.38	0.45	0.36	0.4	0.54	0.57	0.83	0.94	1.52	5.20
Jambi	0.86	0.5	0.55	1.2	1.26	0.22	0.19	0.65	0.69	1.12	0.80
Sumatera Selatan	0.8	0.98	1.26	1.48	5.65	2.68	0.00	0.00	0.00	0.00	0.00
Bengkulu	0.7	0.02	0.02	0.41	0.46	0.48	0.82	0.88	0.89	1.43	1.26
Lampung	1.94	1.68	1.68	6.23	6.36	1.61	1.70	1.65	1.68	2.72	0.87
DKI Jakarta	2	5.26	5.26	8.52	7.75	7.75	1.55	2.15	2.31	3.74	1.16
Jawa Barat	4.41	4.12	7.46	4.77	5.57	6.87	8.09	7.28	7.19	11.66	1.63
Jawa Tengah	8.44	8.95	9.39	9.44	9.75	7.98	8.38	8.52	8.67	14.04	1.03
DI Yogyakarta	0.9	0.81	0.75	0.75	0.92	0.94	0.98	0.85	0.88	1.42	0.97
Jawa Timur	17.18	20.1	19.95	19.32	19.05	19.82	19.88	22.10	23.24	37.66	1.35
Bali	0.56	0.55	0.61	0.59	0.8	0.7	0.80	0.81	0.87	1.41	1.55
Nusa Tenggara Barat	0.3	0.24	0.22	0.31	0.31	0.28	0.32	0.39	0.40	0.65	1.33
Nusa Tenggara Timur	0.1	6.12	0.61	2.48	0.4	0.36	0.79	0.73	0.68	1.10	6.79
Timor-Timur	0.1	0.8	0.88	0.99	1.18	0.88	1.40	1.54	1.69	2.75	16.94
Kalimantan Barat	0.64	0.3	0.3	2.54	1.23	0.24	0.27	0.37	0.43	0.70	0.67
Kalimantan Tengah	0.1	0.1	0.14	0.12	0.12	0.03	0.03	0.05	0.04	0.06	0.37
Kalimantan Selatan	0.2	0.14	0.14	0.15	0.17	0.18	0.31	0.38	0.11	0.18	0.54
Kalimantan Timur	0.31	0.15	0.15	0.32	0.22	0.3	0.35	0.42	0.47	0.76	1.52
Sulawesi Utara	0.14	0.15	0.15	1.33	1.89	0.48	0.49	0.50	0.51	0.83	3.66
Sulawesi Tengah	0.07	0.18	0.18	0.2	0.22	0.52	0.64	0.76	0.78	1.26	11.09
Sulawesi Selatan	0.55	0.28	0.31	0.34	0.36	0.24	0.18	0.19	0.19	0.30	0.34
Sulawesi Tenggara	0.17	0.6	0.67	0.49	0.39	0.44	0.50	0.38	0.39	0.64	2.31
Maluku	0.1	0.61	0.71	0.55	0.58	0.3	0.31	0.30	0.34	0.54	3.35
Irian Jaya	0.1	0.12	0.28	0.29	0.32	0.08	0.10	0.18	0.21	0.33	2.06
Indonesia	49.5	58.26	57.02	68.76	71.19	57.07	55.89	59.61	61.70	100.0	1.25

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.106 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.81 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data.

Sheep numbered about 7 169 000 in 1995. About 6 400 000 are kept by farmers on Java. The operators of small farms keep virtually all the sheep. The 1995 population was a 47 percent increase over the 1985 sheep population (Table 40). Sheep and mutton production was about 45 000 t in 1995. Almost all of the recorded sheep meat production took place in the provinces of Java (Table 41). Goats and sheep are mostly consumed during special festivals such as *Idul Adha* (the *Haj* celebration) where a lot of goats and sheep, as well as some cattle are sacrificed for the poor, and during the *Idul Fitri* (this is at the end of the fasting month of *Ramadham*).

Table 40. Sheep population 1985 to 1997, by province^(a)

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(b)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	149	94	97	104	102	117	120	128	144	1.81	0.97
Sumatera Utara	58	85	91	95	101	120	139	146	154	1.93	2.66
Sumatera Barat	0	4	4	4	4	2	2	2	2	0.02	nc
Riau	1	0	0	0	0	0	1	0	0	0.00	0.00
Jambi	28	42	47	42	40	42	46	51	53	0.66	1.89
Sumatera Selatan	100	105	106	104	94	86	84	103	103	1.30	1.03
Bengkulu	27	35	36	36	35	29	23	21	20	0.25	0.75
Lampung	32	42	43	50	27	31	31	32	33	0.41	1.02
DKI Jakarta	4	4	4	3	4	3	2	1	1	0.02	0.35
Jawa Barat	1 999	3 001	3 053	3 052	3 162	3 326	3 543	3 778	3 810	47.85	1.91
Jawa Tengah	1 296	1 312	1 309	1 402	1 382	1 545	1 716	1 766	1 818	22.84	1.40
DI Yogyakarta	74	75	75	76	73	77	77	78	78	0.98	1.05
Jawa Timur	917	988	1 014	1 046	1 015	1 159	1 170	1 401	1 496	18.79	1.63
Bali	1	<1	<1	1	<1	<1	0	0	0	0.00	0.25
Nusa Tenggara Barat	45	35	39	36	35	38	39	40	42	0.53	0.93
Nusa Tenggara Timur	79	102	106	103	99	108	111	115	145	1.82	1.84
Timor-Timur	28	31	33	33	32	31	32	32	33	0.42	1.19
Kalimantan Tengah	1	1	1	1	<1	1	0	0	0	0.00	0.07
Kalimantan Selatan	7	5	5	3	4	4	4	4	4	0.06	0.63
Kalimantan Timur	5	3	5	2	3	3	3	3	3	0.03	0.54
Sulawesi Tengah	16	18	19	20	19	10	11	8	8	0.10	0.52
Sulawesi Selatan	14	15	15	12	2	2	2	2	2	0.02	0.13
Sulawesi Tenggara	<1	<1	<1	<1	<1	<1	0	0	0	0.00	nc
Maluku	6	6	6	7	7	7	7	7	8	0.10	1.27
Irian Jaya	1	1	1	1	1	1	2	2	3	0.03	2.56
							0	0	0	0.00	nc
Indonesia	4 885	6 006	6 108	6 235	6 240	6 741	7 168	7 724	7 963	100.00	1.63

Notes: ^(a) Provinces without sheep in any of the years in the table have been excluded from the table.

^(b) Preliminary figures

Source: Direktorat Jenderal Peternakan (pers. comm.) for 1995 data; Direktorat Jenderal Peternakan (1996), p.82 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.3 for 1985 data.

Table 41. Mutton and lamb production 1985 to 1997, by province

Province	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.56	0.49	0.52	0.55	0.62	0.25	0.33	0.37	0.36	0.88	0.65
Sumatera Utara	0	0.51	0.42	0.56	0.58	0.37	0.48	0.73	0.77	1.86	nc
Sumatera Barat	0	0.06	0	0	0	0	0.00	0.00	0.00	0.01	nc
Jambi	0.07	0.14	0.16	0.64	0.65	0.07	0.07	0.08	0.08	0.19	1.13
Sumatera Selatan	0.12	0.15	0.25	0.21	1.42	0.52	0.57	0.37	0.28	0.67	2.29
Bengkulu	0.26	0	0	0.23	0.35	0.24	0.15	0.13	0.13	0.31	0.48
Lampung	2.42	0.29	0.29	1.25	0.93	0.19	0.12	0.12	0.12	0.30	0.05
DKI Jakarta	0.76	2.5	2.5	5.7	5.77	5.77	0.94	1.32	1.32	3.20	1.74
Jawa Barat	12.43	11.35	16.96	4.61	12.17	18.06	17.01	17.07	19.57	47.43	1.57
Jawa Tengah	5.04	5.68	5.51	5.81	6.04	5.02	5.86	5.54	5.24	12.70	1.04
DI Yogyakarta	1.19	1.3	1.13	1.02	1.59	1.51	1.52	1.75	1.25	3.03	1.05
Jawa Timur	6.04	8.86	9.31	9.34	9.62	10.36	10.77	11.08	11.64	28.23	1.93
Nusa Tenggara Barat	0.04	0.05	0.07	0.07	0.07	0.05	0.06	0.07	0.06	0.13	1.38
Nusa Tenggara Timur	0	0.1	0.02	0.01	0	0	0.00	0.00	0.00	0.00	nc
Timor-Timur	0.36	0.17	0.17	0.18	0.2	0.11	0.19	0.31	0.34	0.81	0.93
Kalimantan Barat	0.17	0	0	0	0	0	0.27	0.00	0.00	0.00	0.00
Kalimantan Tengah	0.01	0.01	0.02	0	0	0	0.00	0.00	0.00	0.00	0.10
Kalimantan Selatan	0.01	0.01	0.01	0.01	0	0.02	0.00	0.04	0.04	0.09	3.70
Kalimantan Timur	0.01	0	0	0	0	0.02	0.00	0.01	0.01	0.01	0.60
Sulawesi Tengah	0.1	0.01	0.01	0.01	0.04	0.06	0.04	0.06	0.06	0.14	0.59
Sulawesi Selatan	0	0.04	0.06	0.01	0	0	0.00	0.00	0.00	0.01	nc
Sulawesi Tenggara	0.21	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
Irian Jaya	0	0	0	0	0.01	0	0.00	0.00	0.00	0.00	nc
Indonesia	29.8	31.72	37.41	30.21	40.05	42.62	38.39	39.03	41.25	100.0	1.38

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (pers.com.) for 1995 data; Direktorat Jenderal Peternakan (1996), p.95 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data.

Pigs

Even though Indonesia is a Muslim country, there is nonetheless a pig meat industry and it is increasing. The number of pigs increased from 5 700 000 to 7 825 000 between 1985 and 1995. Most pigs are to be found on Sulawesi, Kalimantan, Bali and Irian Jaya. The provinces on Java had just over a quarter of a million pigs in 1995 (Table 42).

Table 42. Pig population 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)	
DI Aceh	10	12	12	2	2	2	1	0	1	0.01	0.05
Sumatera Utara	1 211	1 971	2 065	2 165	2 340	2 388	921	948	976	11.30	0.81
Sumatera Barat	20	20	21	19	32	33	46	47	47	0.55	2.36
Riau	33	44	47	43	192	217	251	364	533	6.17	16.16
Jambi	16	10	10	11	11	12	10	8	8	0.09	0.50
Sumatera Selatan	97	119	125	175	181	201	204	77	79	0.91	0.81
Bengkulu	<1	1	1	1	1	1	1	1	1	0.01	nc
Lampung	42	30	50	61	67	73	72	76	79	0.92	1.88
DKI Jakarta	54	49	49	44	43	42	9	8	0	0.00	0.00
Jawa Barat	35	41	46	17	158	50	42	53	50	0.58	1.44
Jawa Tengah	142	142	146	149	157	140	133	120	109	1.27	0.77
DI Yogyakarta	14	12	10	8	10	9	9	8	8	0.09	0.56
Jawa Timur	89	83	82	79	64	57	63	55	55	0.63	0.61
Bali	776	941	993	1 047	1 091	1 056	1 080	1 073	1 080	12.50	1.39
Nusa Tenggara Barat	16	21	32	23	23	24	23	24	26	0.30	1.64
Nusa Tenggara Timur	884	1 162	1 214	1 341	1 423	1 406	1 538	1 589	2 229	25.81	2.52
Timor-Timur	182	276	315	350	389	308	343	378	416	4.82	2.29
Kalimantan Barat	603	618	668	622	789	912	924	616	700	8.10	1.16
Kalimantan Tengah	145	117	121	142	92	129	137	144	154	1.78	1.06
Kalimantan Selatan	10	9	9	12	13	13	12	11	11	0.13	1.12
Kalimantan Timur	62	81	75	85	90	98	107	114	117	1.36	1.89
Sulawesi Utara	231	371	408	453	485	519	556	500	535	6.19	2.32
Sulawesi Tengah	86	149	169	187	207	139	150	173	188	2.18	2.19
Sulawesi Selatan	350	352	358	405	234	520	555	575	576	6.67	1.65
Sulawesi Tenggara	7	14	15	16	13	13	14	17	18	0.21	2.60
Maluku	77	87	0	86	90	92	96	100	108	1.25	1.40
Irian Jaya	506	405	570	594	618	407	427	517	533	6.17	1.05
Indonesia	5 700	7 136	7 612	8 135	8 704	8 858	7 720	7 597	8 638	100.00	1.52

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.94 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.83 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.3 for 1985 data.

Table 43. Pork production 1985 to 1997, by province

Provinces	1985	1990	1991	1992	1993	1994	1995	1996	1997 ^(a)		1997/1985
	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(kt)	(%)	
DI Aceh	0.09	0.3	0.25	0.09	0.04	0.05	0.02	0.01	0.01	0.00	0.07
Sumatera Utara	32.25	16.16	11.66	13.22	17.62	29.43	29.98	33.97	34.98	17.74	1.08
Sumatera Barat	1.08	0.21	0.22	1.26	1.28	0.64	0.64	0.50	0.54	0.27	0.50
Riau	3.14	3.62	3.71	1.27	4.22	2.81	2.85	2.94	4.30	2.18	1.37
Jambi	0.92	1.18	0.88	0.34	0.26	0.56	0.61	0.64	0.67	0.34	0.73
Sumatera Selatan	3.36	5.27	5.5	6.32	10.47	4.23	3.89	4.51	4.61	2.34	1.37
Bengkulu	0	0	0	0.02	0.02	0.03	0.02	0.02	0.02	0.01	nc
Lampung	3.99	0.59	0.59	3.18	3.2	1.63	1.67	1.82	1.91	0.97	0.48
DKI Jakarta	26.01	27.46	27.46	28.09	26.83	26.83	12.89	12.70	12.76	6.47	0.49
Jawa Barat	3.32	2.94	2.82	1.23	4.59	4.16	4.67	5.11	5.10	2.59	1.54
Jawa Tengah	4.53	4.13	4.48	4.03	3.46	3.15	2.94	2.28	1.77	0.90	0.39
DI Yogyakarta	0.72	0.93	0.94	0.71	0.88	0.51	1.02	0.59	0.61	0.31	0.84
Jawa Timur	7.82	8.26	8.33	8.69	9.27	8.47	8.46	8.37	6.68	3.39	0.85
Bali	15.41	17.02	17.45	18.74	20.87	62.24	69.71	73.42	79.77	40.47	5.18
Nusa Tenggara Barat	0.4	0.31	0.29	0.64	0.64	0.55	0.40	0.71	0.71	0.36	1.78
Nusa Tenggara Timur	7.33	15.15	1.6	5.42	1.86	2.02	2.94	2.54	2.19	1.11	0.30
Timor-Timur	0.85	1.67	1.92	2.36	2.72	4.83	1.93	2.17	2.43	1.23	2.85
Kalimantan Barat	4.86	8.65	0	14.42	15.06	9.96	10.10	10.86	11.04	5.60	2.27
Kalimantan Tengah	0.83	1.15	0.83	0.82	1.13	0.51	0.61	0.68	0.68	0.34	0.82
Kalimantan Selatan	0.13	0.05	0.05	0.12	0.28	0.14	0.15	0.24	0.12	0.06	0.88
Kalimantan Timur	0.64	0.28	0.22	0.53	0.54	1.09	1.36	0.94	0.96	0.49	1.50
Sulawesi Utara	3.58	3.18	3.18	20.71	24.94	13.34	14.28	15.28	15.68	7.95	4.38
Sulawesi Tengah	6.72	0.4	0.41	0.43	0.5	1.03	1.22	1.80	1.91	0.97	0.28
Sulawesi Selatan	2.53	3.59	3.66	3.73	3.74	2.63	2.70	2.78	2.85	1.45	1.13
Sulawesi Tenggara	0.19	0.24	0.32	0.31	0.36	0.34	0.37	0.36	0.37	0.19	1.94
Maluku	0.6	0.62	0.64	0.58	0.59	0.27	0.29	0.30	0.32	0.16	0.53
Irian Jaya	1.4	0.45	12.64	12.64	13.95	2.18	2.11	4.03	4.15	2.10	2.96
Indonesia	133.2	123.81	110.05	149.9	169.32	183.63	177.82	189.54	197.12	100.0	1.48

Notes: ^(a) Preliminary figures

Source: Direktorat Jenderal Peternakan (1997), p.108 for 1995 to 1997 data; Direktorat Jenderal Peternakan (1996), p.96 for 1990 to 1994 data; Direktorat Jenderal Peternakan (1988), p.32 for 1985 data.

PROGRAMMES TO INCREASE LIVESTOCK NUMBERS

Live cattle

Indonesia has had programmes for importing live cattle for at least the last two decades. For much of the period 1980-1990, breeding cattle were imported as draught cattle and as breeding cattle for the transmigration programme¹³. More than 118 000 head were imported from Australia (Linnebar and Maher, 1994). More recently, live cattle imports were predominately for feedlots although some breeder cattle were still being imported. Since the financial crisis hit Indonesia, live cattle imports have all but stopped. It is generally thought that once stability returns to the Indonesian economy, live cattle imports will resume.

The idea of the breeder cattle programme is that the farmer will be able to increase cattle numbers through breeding from a female. Most of the animals imported for the breeder programme have come from the north of Australia and have been *Bos indicus* type. A difficulty with this is that cattle are dispersed to small farmers, many of whom have been primarily engaged in crop production. This means that they may regard the animal as an intermediate input into crop production. The cattle from northern Australia are unlikely to be particularly suited to this because they have not had much handling. Farmers used to feeding a draught animal during the period when it is used for draught purposes may not understand the need to provide supplementary feed to maintain the animal's condition at other times.

Until 1989, imports of feeder cattle into Indonesia were strictly controlled by the Ministry of Agriculture through the Directorate General of Livestock Services. In 1989, policies were revised so that importing became easier. This was done to meet a production shortfall and to reduce pressure on the national herd (Linnebar and Maher 1994). Live feeder cattle imported into Indonesia and weighing less than 350 kg are now not subject to import tariffs. Slaughter cattle on the other hand face a tariff of 15 percent while beef has a tariff of 20 percent (Box 1). Importers of feeder cattle are required to obtain import permits. These were previously provided on a yearly basis but they are now released on a ship by ship basis to stop out-of-specification heavy cattle from entering Indonesia and to maintain a healthy trade. Permits are based on performance criteria such as feedlot space, cattle specifications and weight (Schick 1997).

¹³ The transmigration programme is a key part of the government's agricultural development programme. It is seen as a way of reducing population pressure in Java, Madura, Lampung, Lombok and Bali by resettling landless and land-poor families in the sparsely populated outer islands.

Box 1. Specifications for live cattle imports

Tariffs

- slaughter cattle 15 percent

Import permits

- required for all cattle types

Specifications

- feeder cattle – preferred minimum 50 percent *Bos indicus* content
- primarily steers, but also heifers (entire or speyed) and entire males
- average shipment weight <350 kg
- no older than 36 months

The feeder cattle programme involves placing imported cattle on feedlots, which could be as small as three head, or large capital intensive operations. The production capacity of this industry has grown from 60 200 animals per year in 1992 to 275 000 animals in 1995 (Table 44). There were 19 companies involved in the feedlot industry in 1995, and as Table 45 shows, most of the industry's capacity was in the provinces of Lampung (34 percent) and West Java (33 percent).

Table 44. Live cattle imports, 1990 to 1995

Year	Feeders	Feedlot capacity of Indonesia	Breeders
1990	3 599	na	5 611
1991	12 293	na	298
1992	24 842	60 200	25
1993	58 534	96 400	0
1994	120 574	124 350	2 204
1995	na	275 000	na

Source: Association of Indonesian Feedlot and Beef Producers (nd) for 1990 to 1994 data

Table 45. Production capacity of feedlots operated by members of the Indonesian Beef Producers and Feedlot Association, 1995

Province	Company	Nucleus pen capacity	Smallholder capacity	Beef production capacity	Production capacity
		(head)	(head)	(t/yr)	(head/yr)
Lampung	Great Giant Livestock Co.	6 000	4 600	900	20 000
	Tipperary Indonesia	14 000	2 100	8 960	56 000
	Hayuni Mas Lestari	1 500	200		6 000
	Suryamatra Ardhatama	1 000	500	3 600	9 000
West Java	Kariyana Gita Utama	4 000	1 500	2 000	24 000
	Lintas Nusa	1 700	120	1 920	9 600
	Kresna Nandi Arsetama	1 000	1 000	5 000	20 000
	Agro Nusa Perdana	2 000	800		9 600
	Dharma Jaya	2 400	200	33 394	4 800
	Karma Madayuna	1 300			9 000
	Lembu Jantan Perkasa	3 100		500	8 700
	Lembu Satwa Prima	2 000		1 800	800
Central Java	Andini Pati Mandiri	1 300	150		6 000
	Murih Mardi Lestari	1 200	400		6 000
	Pakar Nusabangun Indonesia	2 000	400		8 000
Yogyakarta	Binakarunia Alamnusantara	3 000			12 000
East Java	INDUK KUD	700	600	1 700	13 200
	Sekar Bumi	3 000	600	2 000	12 000
	Suryadi Feedlot	1 200	350		
East Kalimantan	Celebes Agro Perdana	1 200		864	4 400
South Kalimantan	Jorong Agro Lestari	3 500	150		
Riau	Tri Bakti Sarimas	6 000	4 000		20 000
Total		63 100	17 670	68 638	259 100

Source: Association of Indonesian Feedlot and Beef Producers (nd)

One of the requirements for the importing of feeder steers by large companies is that they in some way include Indonesian smallholders in beef production. This is the Nucleus Smallholder Scheme, discussed in Chapter 2. Corporations have two options under the scheme. They can contract the smallholder to fatten a percentage of the imported cattle, or they can purchase feed from smallholders for use in the feedlot (Linnebar and Maher, 1994). Smallholders fattening cattle typically do so for 60 days and are paid on the weight of the animal. In late 1997, farmers made about Rp. 50 for each kilogram of liveweight gain. Producers are discouraged from marketing the animals through the wet market.

Credit programmes

Kristanto (1982) reviewed a number of programmes that have been used in Indonesia. Two of these, introduced in the 1970s, are outlined here.

- The Credit Programme to assist smallholders with the fattening of cattle (Panca Usaha Ternak Pot.g) was introduced in 1977. It gave the farmer a credit package for the purchase of one cow, feed, labour, health care and a small yard. Repayment had to be made within six months, at an interest rate of 1.25 percent per month. It was assumed that this period was sufficient to fatten the animal, sell it and make a profit. It was also assumed that after three successful loans, the farmer would have made enough profit to purchase an animal. The programme was cancelled after two years because of lack of smallholder involvement. The programme failed in the opinion of Kristanto because it did not recognize that farmers keep cattle as a store of wealth and as a source of draught power. Also, farmers were uncertain about their ability to repay the loan because of the small market for fattened cattle.
- The Credit Programme for Breeding Cattle (Panca Usaha Ternak Bibit) was also introduced in 1977. It gave the farmer credit to purchase five animals, erect a yard, and buy feed, medicines and labour. At the end of three years, the farmer must return three cattle and another two at the end of the fifth year. The programme has been successful because all offers of credit have been taken up. It allows the farmers flexibility in their decision making.

GOVERNMENT POLICIES

Crops and government policies

Since the early 1980s trade policy in Indonesia has changed significantly with the government trying to make export earnings less dependent upon oil (Kasryo and Suryana, 1992). Encouragement of more private sector involvement and encouragement of more non-oil exports have been major objectives. As Kasryo and Suryana point out, agriculture has been directly affected by the reforms in which a more systematic set of policy instruments has been substituted for non-tariff barriers such as export quotas. More value adding is an objective of government policy for the agricultural sector, and the private sector – particularly that part involved in processing activities – is seen to play an important role in achieving this objective.

With regard to specific commodities, the price competitiveness of corn, cassava, soybeans and sugar was investigated by the International Food Policy Research Institute (1996). Since less than 15 percent of the cost of production comes from material inputs, and this was used as an argument for using relative domestic prices as a measure of price competitiveness. Cassava, soybeans and corn are part of the *palawija* or the secondary food crops sector. Sugar cane is considered an estate crop. According to the International Food Policy Research Institute (1996), from the mid-1970s until the mid-1980s, government policies were heavily biased towards rice. The relative price of rice to other crops was in favour of rice.

The International Food Policy Research Institute (1996) reports that while much of Indonesia's agricultural trade has been heavily regulated, agriculture has, until recently, been

largely isolated from the trade reform programmes that began in 1985¹⁴. The reform programme reduced the tariffs and raised the number of items with low tariffs. Agricultural commodities imported by BULOG or by other state trading companies covered 54 percent of domestic production in 1986. The 1991 trade policy reforms, which focused on agriculture, reduced to 30 percent the share of agricultural production subject to import licences (International Food Policy Research Institute, 1996).

In 1989 BULOG's monopoly in corn importing was withdrawn. The floor price for corn (this programme began in 1978) was discontinued in 1990. Nominal protection for corn has been estimated to be moderately negative in the mid-1980 and moderately positive in recent years. Import restrictions have continued to apply to soybeans while cassava (which is exported by Indonesia) is almost free of government intervention.

Foreign investment, particularly in poultry, was important in the growth of the livestock industries. The government has used regulations to control investment in the food processing industries.

Table 46 contains estimates of the domestic resource cost (DRC)¹⁵ to shadow exchange rate (SER) ratio assembled by Gunawan (1995). The estimates of the DRC/SER ratio shows that major food crops in many parts of the country lack comparative advantage. Gunawan argues that "market inefficiency is probably one of the most important factors which caused high production costs and uncompetitiveness of Indonesian food commodity on the world market" (p.13). More specifically, he identifies five general factors leading to market inefficiencies. These are: an imbalance in market power between farmers and traders in favour of the traders; excessive protection of inputs; a deficient incentive system, such as a lack of infrastructure and legal support; improper harvesting, storage and transportation technologies¹⁶; and weak co-operation between various levels of agribusiness.

¹⁴The major policy instruments consisted of tariffs import licensing, export taxes and informal export quotas. Markets have been regulated through administered prices to give consumers low prices, to protect farmer incomes, to reduce excessive price instability and to encourage domestic processing industries.

¹⁵ The domestic resource cost is sometimes used to measure the comparative advantage of an industry. It is the domestic resources required to produce one unit of foreign exchange. An industry has a comparative advantage if the domestic resource cost is less than the shadow exchange rate. This means that the ratio DRC/SER should be less than 1.

¹⁶ Gunawan (1995) says that grain losses amount to 10% to 15% and horticultural losses are about 30% because of improper harvesting and post harvest treatment.

Table 46. DRC/SER for several food commodities in Indonesia, 1989 and 1994

Commodity	West Sumatra	West Java	Central Java	East Java	South Sulawesi
Rice	1.2	0.83	0.77	0.87	0.99
Corn	0.74	0.71	0.76	0.83	0.77
IS ^(a)		0.86	0.54	0.7	0.85
EP ^(b)		1.53	0.93	1.23	0.75
Soybean	1.24	1.27	1.28	1.38	1.08
IS ^(a)		1.41	0.66	0.95	0.46
EP ^(b)		1.59	0.76	1.07	0.56
Cassava ^(c)		0.46	0.41	0.46	0.31
Sugar	1.73	1.80			

Notes: ^(a) Under import substitution assumption (Kasryo and Simatupang, 1990); ^(b) Under export promotion assumption (Kasryo and Simatupang, 1990); ^(c) Under export promotion assumption (Kasryo and Simatupang, 1990).

Source: Gunawan (1995), p.9.

Indonesia has been reducing the number of industries in its negative investment list. This list is made up of industries in which production capacity has not been fully used. Since the introduction of this measure in 1989, the number of industries on the list had been reduced from 75 to 33 by late 1995. Powdered milk and condensed milk are still on the list, except if the planned new investment is integrated with dairy cattle raising.

Border protection

Since January 1993, Indonesia has begun to implement the ASEAN Free Trade Agreement, under which a Common Effective Preferential Tariff is to be introduced by 2003. When fully implemented, intra-ASEAN trade will be subject to maximum tariffs of 5 percent, subject to exclusions, including services and most unprocessed agricultural products (General Agreement on Tariffs and Trade, 1995). There are some in Indonesia who argue that Indonesia will be ready by 2000 to export livestock to other ASEAN countries because by then Indonesia will have overcome its sanitary and livestock disease problems. This prediction was made before the depreciation of the rupiah in 1997 and 1998. Indonesia was a member of the Cairns Group during the Uruguay Round of trade negotiations conducted under the auspices of the GATT. Indonesia's commitments on tariff bindings cover all agricultural tariff lines, most of which represent new bindings. Tariff bindings will initially range from 10 percent on non-wheat cereal flour to 238 percent on some dairy products. These rates are above existing tariff rates for livestock products. Ceilings are to be reduced by Indonesia over a ten year period by a minimum of 10 percent each (General Agreement on Tariffs and Trade, 1995). Its general obligations to liberalization are summarized by Table 47 and Box 2, while Table 48 shows the commitment Indonesia has given for livestock and feed inputs. There is some uncertainty about the extent to which these will now be changed as announcements have been made that under the IMF programme tariffs will be reduced on many products to 0 percent or 5 percent.

Table 47. Tariff bindings made by Indonesia as a result of the Uruguay Round

Item	No.	Percent	US\$ million	Percent
Total bound manufactures	7 537	80.3	22 529	82.6
• existing bindings	823	8.8	6 227	22.8
• new bindings	6 714	71.6	16 302	59.8
Total agriculture (all bound)	1 341	14.3	2 464	9.0
Exceptions	504	5.4	2 285	8.4
Total	9 382	100.0	27 279	100.0

Box 2. Summary of Indonesia's Uruguay Round commitments on agriculture

- Tariffic-setting and binding, or ceiling binding for all agricultural items
- Duty reduction of 10 percent by tariff line over 10 years
- Elimination of local content requirements for fresh milk products and soybean oil cake
- Agreed annual access of 70 000 t of rice import. Dairy products, some of which were previously bound at a rate of 10 percent were all tariffed at an initial rate of 238 percent, subject to maintaining current market access of 414 700 t of dairy products (fresh milk equivalent) at a reduced maximum bound in-quota rate of 40 percent. According to General Agreement on Tariffs and Trade (1995), "Indonesia has agreed to levy a lower tariff of 5 percent on in-quota imports of dairy products"(p.26).
Removal of non tariff barriers on bound tariff items
- Non-tariff barriers (NTBs) on 98 industrial tariff lines affecting US\$358 million of imports (1992) to be removed within 10 years
Elimination of import surcharge on bound tariff items
- Surcharges varying between 5 percent and 25 percent on 159 tariff lines affecting US\$838 million of imports (1992) to be removed within 10 years.

Table 48. Market access commitments by Indonesia on livestock feed inputs

H.S. Chapter/Code	Product	Existing tariff	Rate of ceiling tariff binding	
			Initial (%)	Final (%)
12.01.00.100	Soybeans	10	30	27
12.08.10.000	Soybean meal	10	45	40
01	Livestock	0, 15	50, 45	40
02	Meat	20, 30	70	50, 40
04	Dairy products	20, 30, 40	50, 70, 100, 238	210, 40
04.07-08	Eggs	20, 30	80, 50	40
10.01.90-10.05, 07, 08, 11.02.10-20, 11.03.09	Cereals & products thereof	5, 10, 15	45	40
12.01.20	Oilseeds	5, 10	45	40

Notes: Under the special safeguard provisions of Article 5 of the Uruguay Round Agreement on Agriculture, members may – if the volume of imports in any year exceeds, or the price of imports¹⁷ falls below certain trigger levels – impose additional duties up to one third of the ordinary customs duty for the remainder of the year in which they are imposed. Information on the trigger prices or volumes could not be obtained. Source: General Agreement on Tariffs and Trade (1995), p.25

¹⁷ PT Surveyor Indonesia, a state inspection company, is responsible for inspection of all imports over US\$5 000. It issues verification reports on the quality, quantity, price and tariff code classification. Import duty is calculated on the basis of its report.

A quantitative assessment of the agricultural results obtained in the round by the OECD and reported by Stephenson and Erwidodo (1995) suggest that the total welfare gains to the world economy in 2002 could be between US\$25 billion and US\$48 billion. Almost all regions gain, although Stephenson and Erwidodo estimate small losses for China, Africa, Canada, Australia and Latin America. The welfare gains for Indonesia are negligible according to the findings of studies cited by Stephenson and Erwidodo (1995). Import prices for wheat, rice, coarse grains and sugar are estimated to remain unchanged, while for oilseeds they are expected to decline by about 33 percent.¹⁸

The Busep or mixing ratio used in the dairy industry (and discussed in an earlier part of this appendix) was to have to been maintained until 2003. By then, the ratio was to have fallen to 1:1.25 (PT Corinthian Infopharma Corpora, 1995). Other government measures in place for the dairy industry include the prohibition of cheese imports, unless special permission has been obtained from the Department of Health. Similarly, importers of yoghurt and other soft products have to apply to the government for permission to import. Most of these regulations have been modified as a result of the IMF reforms.

CONSUMPTION

Per person consumption of livestock products

Figure 11 shows per person consumption of animal products in Indonesia since 1969. According to Hutabarat (1996), information on consumption of dairy products before 1969 is not available. It seems that this is also the case for meat and for eggs. It is apparent from Figure 12 that consumption has increased dramatically since 1969, presumably because of income increases. In percentage terms, the largest increase occurred for eggs. Data presented later in this part of the report show that meat, eggs and milk are income elastic for all but the highest income families.

¹⁸Dairy prices and meat prices are estimated to remain unchanged as a result of the Uruguay Round outcome.

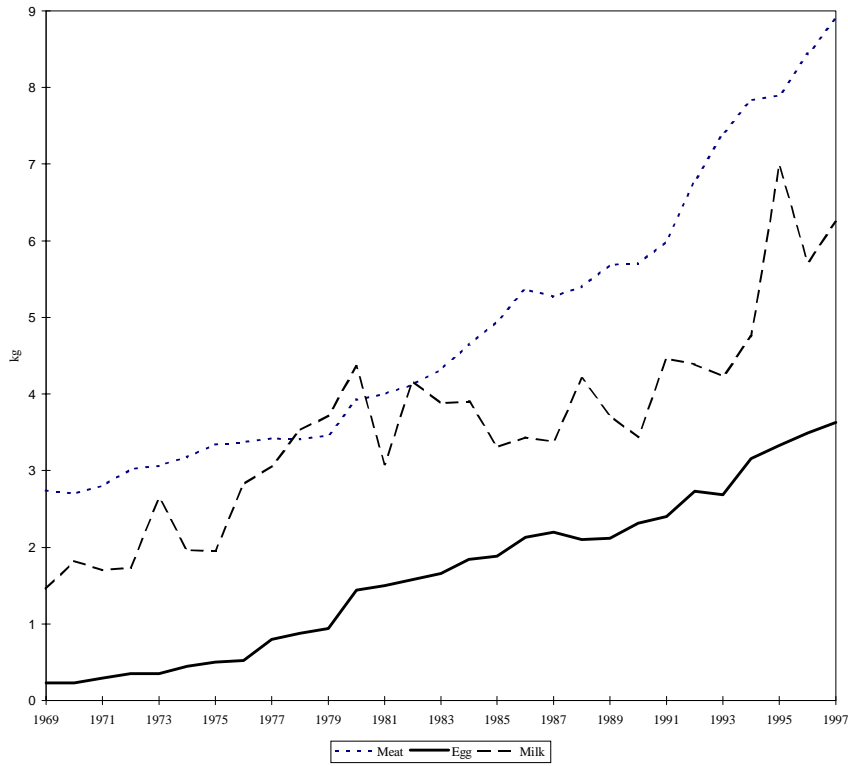


Figure 11. Annual consumption per person of meat, eggs and milk

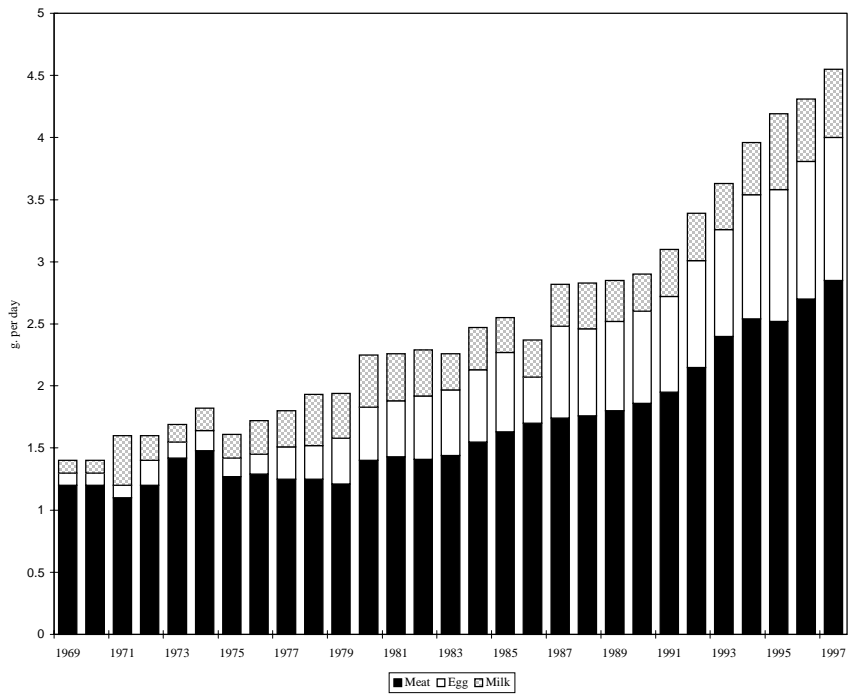


Figure 12. Daily per person consumption of meat, eggs and milk

Price and income elasticities

An Indonesia study conducted by Oka and Rachman (1991) made use of cross-sectional data collected in the 1987 national consumer expenditure survey (SUSENAS). According to the

authors, this survey provides a “high quality series” (p.53) of data. Demand models were estimated using a double log specification, with prices and income as explanatory variables. Seemingly unrelated least squares was used to obtain the parameter estimates. Estimates were obtained for five different income groups. Income group I had a monthly income per person of less than Rp. 25 000; group II had an income range of Rp. 25 000 to Rp. 74 999; group III had a range of Rp. 75 000 to Rp. 149 999; group IV income was from Rp. 150 000 to Rp. 300 000; and group V income was over Rp. 300 000. The results obtained by Oka and Rachman are reproduced in Table 49 and in Table 50. A number of the elasticity estimates have the wrong sign. While not commenting on these, Oka and Rachman acknowledge that in their models, “parameter estimates will suffer from bias caused by ... excluded variables” (p.56).

Table 49. Own price elasticities by area and by income, national economic survey, 1987

Food group	Income group										Indonesia	
	I		II		III		IV		V		urban	rural
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural		
Energy food												
Rice & other cereals	0.34	0.11	0.34	0.06	0.29	0.13	0.18	0.33	-0.2	0.13	0.9	0.10
Starchy foods	-0.28	-0.25	-0.23	-0.20	-0.31	-0.24	-0.47	-0.31	-0.53	-0.31	-0.37	-0.21
Oil & fat	-0.50	-0.48	-0.36	-0.47	-0.44	-0.50	-0.47	-0.51	-0.26	-0.5	-0.37	-0.45
Body building foods												
Fish	0.77	0.45	0.23	0.37	0.35	0.40	0.20	0.33	0.09	0.59	0.25	0.40
Meat	-0.30	-1.02	-0.43	-0.95	-0.54	-0.80	-0.49	-0.74	-0.50	-0.41	-0.42	-0.62
Eggs	-1.0	-0.69	-0.73	-0.75	-0.75	-0.76	-0.76	-0.72	-0.68	-0.83	-0.71	-0.72
Milk	-1.61	-0.87	-0.46	-0.09	-0.13	-0.08	-0.09	-0.07	-0.17	-0.26	-0.10	-0.07
Leguminous	0.26	-0.52	-0.34	-0.34	-0.33	-0.37	-0.32	-0.30	-0.12	-0.26	-0.13	-0.24
Body regulating foods												
Vegetables	-0.01	-0.05	0.02	0.03	0.03	0.05	0.07	0.03	0.29	-0.04	0.17	0.12
Fruit	-0.50	-0.43	-0.24	-0.05	-0.21	-0.09	-0.24	-0.08	-0.14	-0.09	-0.18	-0.05
Miscellaneous	0.33	0.33	0.35	0.29	0.35	0.27	0.28	0.18	0.25	0.15	0.32	0.27

Source: Oka and Rachman (1991), p.66

Tables 51 and 52 show estimates of elasticities for other commodities, found from the literature.

Table 50. Income elasticities by area and by income group, national economic survey, 1987

Food group	Income group										Indonesia	
	I		II		III		IV		V		urban	rural
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural		
Energy food												
Rice & other cereals	-0.08	0.24	-0.06	0.20	-0.05	0.15	-0.03	-0.15	0.06	0.01	0.03	0.16
Starchy foods	-0.01	0.15	-0.17	0.09	0.15	0.27	0.24	0.24	0.14	0.25	-0.09	-0.22
Oil & fat	1.40	1.10	0.67	0.94	0.67	0.80	0.57	0.51	0.26	0.05	0.38	0.53
Body building foods												
Fish	-1.66	-1.54	0.95	0.94	0.36	0.69	0.19	0.18	0.22	-0.21	0.53	0.62
Meat	1.69	1.75	1.58	1.87	1.33	1.37	1.24	1.32	1.02	0.48	0.95	0.81
Eggs	2.36	2.94	1.38	1.41	1.18	1.38	1.04	1.10	0.45	0.79	0.50	0.76
Milk	0.16	0.01	0.27	0.04	0.23	0.15	0.26	0.16	0.08	0.47	0.05	0.01
Leguminous	0.87	1.33	1.10	0.88	0.94	0.76	0.87	0.85	0.40	0.42	0.38	0.48
Body regulating foods												
Vegetables	0.73	0.70	0.56	0.71	0.62	0.75	0.57	0.62	0.32	0.33	0.35	0.50
Fruit	0.55	0.49	0.59	0.56	0.76	0.74	0.87	0.74	0.56	0.37	0.54	0.52
Miscellaneous	-0.02	0.01	0.09	0.05	0.16	0.17	0.36	0.32	0.43	0.27	0.14	0.07

Source: Oka and Rachman (1991), p.67

Table 51. Elasticities for Indonesia, various authors

Item	Value
Corn	
• own price elasticity	-0.261
• cross price elasticity with respect to cassava	0.056
• cross price elasticity with respect to soybean	0.027
Cassava	
• own price elasticity	-0.390
• cross price elasticity with respect to corn	0.040
• cross price elasticity with respect to soybeans	-0.029
Soybean	
• own price elasticity	-0.779
• cross price elasticity with respect to corn	0.025
• cross price elasticity with respect to cassava	-0.037
Beef	
• own price elasticity	-0.515
• cross price elasticity with respect to poultry	0.155
Poultry	
• own price elasticity	-0.647
• cross price elasticity with respect to beef	0.101
Expenditure elasticities	
• eggs	0.80
• dairy	0.90

Table 52. Income elasticities for Indonesia

Item	Elasticity
Red meat	2.08
Meat	2.71
Eggs and poultry	2.16
Dairy	1.40
Red meat	1.3
Poultry	1.2
Pork	1.0
Fresh milk	1.2
Milk powder	1.0
Total livestock products – urban	1.2
Total livestock products – rural	1.6
Total livestock products	2.16
Pork	1.0
Duck eggs	1.0
Beef	1.2
Mutton.	1.2
Poultry meat	1.5
Poultry eggs	1.5

Source: Winrock International Institute for Agricultural Development (1986)

TECHNICAL COEFFICIENTS

Production parameters

Economic model building requires estimates of technical coefficients relating to mortality, fertility and parturition. Gathering such information for Indonesia is a very difficult task because of the wide diversity of agricultural producing regions and because small farmers – who generally do not keep good records – are such an important part of the livestock sector. By developed country standards, the productivity of animals is often low.

Zemmelink and Subagiyo (1992) investigated the use of metabolizable energy in East Java using data from the 1980s. They conducted a number of analyses. One of their results was that “maintenance and production of the existing herd accounts for less than half” (p.196) of the metabolizable energy available, suggesting that liveweight gain could be doubled by keeping more animals to use the wasted materials. However, they point out that for this to happen, large amounts of supplements would be necessary because of the poor quality of the available roughage to livestock farmers in East Java. Zemmelink and Subagiyo point out that great care needs to be used in analyses of the type they carried out. They explain that data on a regional basis and by season are needed¹⁹. Also information on voluntary intake of feeds and animal response to different feed types would be required for a full understanding of the increased production potential.

Information on production parameters is valuable for gaining an understanding the management processes of farmers. Perkins and Semali (1992) set out to investigate why

¹⁹ The seasonal issue is important. The Food and Fertilizer Technology Center (1995) point out that “in Indonesia the quality of grassland in some rainfed areas during the dry season is so poor that it can hardly maintain life, and mature animals lose 15-25% of their body weight” (p.6).

Indonesian farmers sell cattle at a young age. They gathered data at the village level and found that early growth was relatively rapid, but it soon fell away. Average weight gain in the two breeds they considered – Ongole and Bali cattle – averaged only 200 g per day after 12 months. Farmers estimated that the additional labour to raise a calf was 0.3-0.5 hours per day in the first two quarters of the calf development, but it then rose steadily to 2 hours per day to reach a plateau at 24 months. This meant that for farmers with alternative employment opportunities, it is rational to sell cattle young, at 9-18 months of age.

Data collected from farmers in West Java and reported by Bazeley *et al.* (1992) indicated that the median calving interval on dairy farms was 684 days. This prolonged calving interval was costing farmers up to Rp. 200 000 per cow per year in 1992. INI ANSREDEF (1995) also commented upon the “low calving rate, caused by prolonged calving interval” (p.23) in the dairy industry. Reasons they provided included the length of time between calving and the first service; the requirement for many services per conception; and a high abortion rate.

Most of the available technical parameters are old and may not now be applicable. Officials associated with the poultry industry say that the technical parameters of that industry are similar to those obtained in high income countries. This is probably correct because such technologies are easily transferred from one country to another. Table 53 presents estimates of technical parameters for the egg and dairy industries that are based upon results obtained in the early 1980s. Data in Table 54 and Table 55, commonly cited in discussions of Indonesia’s livestock sector, are based upon data from the 1970s. This raises doubts about the applicability of the data for the late 1990s.

Table 53. Egg and milk production parameters, Indonesia

Item	Native chicken	Layer	Duck	Dairy cattle
	(%)	(%)	(%)	(%)
Productive females in the population	30	60	60	42
Average production per head				
• milk ^(a) (litres)				13.3
• kilograms	1.4	10.8	120	
Average production per head per year by usage				
• consumed	50	98	70	87.5
• spoiled	25	0.5	15	2.5
• hatched	25	1.5	15	
• for calf rearing				10

Note: Data are for 1982 with the exception of the data from INI ANSREDEF (1995) which were for 1993.
Source ^(a) INI ANSREDEF (1995); Direktorat Bina Program Direktorat Jenderal Peternakan (1991), *Buku Statistik Peternakan [Statistical Book on Livestock]*, p.105.

Table 54. Percentage of livestock births per species, 1979

Livestock species	Births	Birth percentage by sex to number of births	
		Male	Female
	(%)	(%)	(%)
Beef cattle	18.31	44.67	55.33
Dairy cattle	22.83	40.77	59.23
Buffalo	17.45	44.3	55.7
Horse	8.77	47.18	52.84
Goat	33.12	42.51	57.49
Sheep	36.4	41.79	58.21
Pig	70.84	50.78	49.22

Notes: Birth percentage based upon livestock numbers at beginning of year
Source: Direktorat Bina Program Direktorat Jenderal Peternakan (1990), *Buku Statistik Peternakan 1990*, p.87

Table 55. Percentage of livestock mortality by species, 1979

Livestock species	Deaths	Cause of death		
		Chronic	Acute	Others
	(%)	(%)	(%)	(%)
Beef cattle	2.16	21.32	54.14	24.54
Dairy cattle	4.1	45.29	54.71	na
Buffalo	4.14	27.78	56.09	16.13
Horse	3.5	23.36	56.16	20.48
Goat	3.87	21.7	50.92	27.38
Sheep	3.73	17.95	55.58	26.47
Pig	13.85	16.15	58.44	25.41

Notes: Deaths as a percentage of population at start of year

Source: Direktorat Bina Program Direktorat Jenderal Peternakan (1990), Buku Statistik Peternakan (1990), pp.87, 84

Feed rations

Lebdosoekojo and Reksohadiprodjo (1982) describe the south east Asian livestock industries as being an important part of the agricultural and ecological balance, especially in the heavily populated regions. Agricultural products are used mainly by the human population and this handicaps the livestock industries, particularly the poultry, swine and dairy industries. Agroindustrial wastes are important and this means that consideration must be given to their availability, the nutritive value and efficiency of rations, relative prices, the level of technology and social acceptability. Lebdosoekojo and Reksohadiprodjo explain that feed substitutes can be classified into energy feeds, protein feeds and roughage depending upon their chemical composition.

- Energy feeds, which include crop and agroindustrial residues (CAIR), have less than 20 percent protein and less than 18 percent crude fibre or less than 35 percent cell wall.
- Protein foods include products that contain 20 percent or more of protein. These can be of plant or animal origin.
- Roughage is usually all products of crop residue, and contains more than 18 percent crude fibre or more than 35 percent cell wall.

Table 56 lists the estimated production and crude protein and energy (TDN, total digestible nutrients) content of crop and agro industrial residues in Indonesia on a dry matter basis.

Table 56. Estimated production and crude protein and energy (TDN) content of crop and agroindustrial residues in Indonesia, dry matter basis, 1979

Product	Quantity	Crude protein	Total digestible nutrients
	(kt)	(%)	(%)
Energy feeds			
Conventional			
• rice bran	2 577	10.7	81.0
• maize bran	403	14.2	90.9
• molasses	343	1.8	53.0
Non-conventional			
• cassava pomace	157	2.6	89.1
• cassava peelings	5 000	3.3	60.7
• gnetum gnemon pulp	na	17.4	40.1
• coffee pulp	89	18.9	47.6
• citrus pulp	6	6.5	43.6
• cocoa husk	1.5	7.4	46.5
• pineapple bran	0.05	3.5	72.0
• banana fruit waste	22.4	6.1	62.8
Protein feeds			
Conventional			
• copra meal	344	21.6	69.3
• peanut meal	11	40.6	52.3
• palm kernel meal	2.2	22.2	58.5
• trash fish & wastes (fishmeal)	355	61.9	69.0
Non-conventional			
• kapok meal	na	32.8	41.6
• rubber seed	na	18.8	62.0
• leucaena seed	na	31.3	59.5
• soybean curd sludge	na	31.4	52.6
• soysauce sludge	na	27.8	80.5
• cassava leaf meal	1 410	22.0	57.8
• leucaena leaf meal	na	22.3	72.5
• sesbania leaf meal	na	25.8	63.0
• snail meal	na	51.2	65.1
Roughage			
Conventional			
• peanut vines	1 025	13.9	67.2
• maize stalk	19 745	6.5	46.6
• sorghum stalk	na	6.5	41.4
• sugar cane tops	174.8	5.4	46.6
Non-conventional			
• rice straw	34 215	5.5	26.6
• soybean straw	na	7.7	50.7
• sweet potato leaf	555	14.6	72.4
• bagasse	1 717.3	2.0	49.4
• sago waste	na	1.8	19.5

Source: Lebdoekojo and Reksohadiprodjo (1982), p.81

The availability and quality of feed is a constraint to the dairy industry. INI ANSREDEF (1995) claim that 90 percent of forage comes from off the farm because farmers do not have sufficient land to produce their own forage – in fact some farmers do not have any land at all.

Smith and Riethmuller (1996) found from a survey of dairy farmers in Java that less than 1 kg of concentrate was fed per day to dairy cattle. They explain that small farmers use a cut and carry system, which involves the farmer (or a labourer employed by the farmer) cutting grasses growing besides roads, irrigation ditches or in forest areas and bringing the grass to the cattle. Water availability and its quality is also a problem, particularly in the dry season²⁰. Animal needs may not be adequately met and there is sometimes insufficient water for adequate levels of farm hygiene²¹.

Gunawan (1995) pointed out that there is a large gap between maximum and actual output from parts of Indonesia's agriculture. To support this view, he presented the data in Table 57. While rice yields are high, perhaps reflecting the priority the government has attached to this industry, most secondary crops are well below their potential yields. Obviously this has implications for the prospects of the livestock industries. Any expansion of these industries will require increased use of secondary crops as animal feed.

Table 57. Actual and percent of maximum potential productivity of some food crops in Indonesia

Crop	Actual productivity ^(a)	Percent of maximum ^(b)
	(t)	(%)
Paddy	4.2	85
Soybean	1.4	40
Cassava	12.1	30
Corn	2.2	30
Sweet potato	9.5	30
Ground nut	1.0	30
Mungbean	0.85	30

Notes: ^(a) CBS data, 1992; ^(b) Based on author's projection (Memed Gunawan)

²⁰ In Java, for example, although the World Bank has pointed out that in aggregate, there is adequate water, season and annual variation are problems. Dry season flows may be only 20% of annual flow and as little as 10% in a dry year. River basins are steep and short (less than 50 km on average) resulting in most wet season water going out to sea.

²¹ The problem of inadequate farm hygiene is also tied to the pricing arrangements that are used in the dairy industry. Farmers pool their milk with others at collection points. Milk is collected from these collection points after rudimentary testing, and from the collection point the milk goes to the co-operative. All farmers delivering to a particular co-operative receive the same price for their milk. Hence there is no incentive for farmers to try to improve the quality of their milk.

THE INDONESIAN FEED INDUSTRY

According to Simatupang and Pakpahan (nd), there was no animal feed manufacturing industry in Indonesia until the end of the 1960s. Beginning in the 1970s, plants began to be built to cater for the needs of the poultry industry. In their examination of the industry, PT Ekamasni Consulting (1995) divided the animal feed industry into the animal feed components industry and the animal feed industry. Firms in the animal feed components industry produce a semi-finished raw material that has to be further processed or mixed with other raw materials to be used as an animal feed. Animal feed components include maize, oil cake from soybean, fishmeal and cassava. The animal feed industry uses the outputs from the components industry to produce compound feed and concentrates. The division used by PT Ekamasni Consulting will be followed to a large degree in this part of the report.

Raw materials used in the Indonesian industry

The main raw materials used in the animal feed industry are listed in Table 58. According to PT Data Consult Inc. (1995), the crucial problem for the industry is the high cost of raw materials. Soybeans are an important import commodity for Indonesia. Most of the soybean grain is used for human consumption whereas soybean oil cake – a by product of the oil processing industry – is used as an animal feed. Soybean imports are controlled by BULOG, while soybean meal was deregulated by the government in 1996, allowing for duty free imports. Maize (corn) has experienced a rapid increase in demand that has outpaced production. As a result, Indonesia is a net corn importer. Indonesia is attempting to increase domestic production through the use of new hybrid varieties. In 1996-1997, approximately 515 000 ha will be sown to new varieties. Feed producing companies are permitted to import corn free of duty. The cost of producing animal feed should decline from 1998 or 1999 when new port facilities will enable larger ships to carry grain imports. Cargill has signed agreements with Indonesian companies to improve port facilities, a development expected to save between US\$8 and US\$10 per tonne. It needs to be noted that industrial residues play an important role in the animal feed industry. Similarly rice straw (for ruminants) and rice bran (for pigs and poultry) play important roles, particularly for smallholders. Manurung (1990) pointed out that crop residue and by-products used for feed represented only about 15 percent of total crop residues available.

Table 58. Raw materials used in the animal feed industry, Indonesia

Seeds	Maize, sorghum
Vegetable proteins	Soybean oil cake, oil cake nuts, canola, corn gluten meal, rapeseed meal
Animal protein	Fishmeal, meat bone meal
General feed I	Rice bran, pollard, oil cake, coconut, sesbania leaf flour, st.e seed, st.e flour
General feed II	Skim milk powder, fish oil, palm oil, sugar cane, salt, premix alimet, choline chloride

Source: PT Ekamasni Consulting (1995)

The animal feed component industry

In 1994 there were 112 animal feed component mills with a total production capacity of 4.8 Mt per year. Most of these mills are in Java (Table 59). Their concentration on Java is not

surprising since this is where the majority of Indonesians live and where the livestock industry, particularly the poultry industry, is concentrated.

Table 59. Animal feed component mills and production capacity, 1994

Province	Number of mills	Production capacity (t/year)
DI Aceh	1	33 600
Northern Sumatra	6	454 300
Riau	2	98 400
Jambi	1	15 000
Southern Sumatra	4	152 880
Bengkulu	1	90 000
Lampung	20	1 216 580
Sumatra	35	2 060 580
DKI Jakarta	3	252 603
West Java	13	319 261
Central Java	15	544 721
East Java	31	1 216 180
Java	62	2 332 765
Bali	2	2 720
West Kalimantan	2	108 000
East Kalimantan	1	42 000
Kalimantan	3	150 000
North Sulawesi	4	68 5000
South Sulawesi	6	151 100
Sulawesi	10	219 600
Indonesia	112	4 765 665

Source: PT Ekamasni Consulting (1995)

The largest producer of animal feed components is PT Japfa Comfeed Indonesia. The company was started in 1971 as PT Java Pelletizing Factory Ltd in a joint venture with the German company Internationale Graanhandel Teghrau. All of the production from this company was exported. In 1982 the firm was taken over by PT Ometraco and its status was changed to the domestic investment scheme. 1989 saw the company going public and changing its name to PT Japfa Comfeed Indonesia after merger with PT Comfeed Indonesia. With the proceeds from going public, Japfa Comfeed acquired shrimp and chicken breeding companies. By 1995, it had become the “leading and most integrated company in agribusiness in Indonesia” (PT Data Consult Inc., 1995, p.13). The capacity of the company is around 470 000 t per year. Table 60 lists the major firms and their locations.

Table 60. Major animal feed producers, Indonesia

Company	Location	Production capacity (t/year)
PT Japfa Comfeed Indonesia	Surabaya	470 000
PT Sprained Soybean Industry	Jakarta	244 000
PT Miter Megan Cattle Feed	Median	160 000
PT Suryadarma Cattle Feed	Deli	160 000
PT Lampung Sumber Kencana P.F.	Lampung	150 000
PT Inti Tapioka	Lampung	150 000
PT Lampung Pelletizing Factory	Lampung	140 000
PT Teluk Intan	Lampung	100 000

Source: PT Ekamasni Consulting (1995)

Between 1989 and 1993, production of the animal feed component industry increased by about 9.6 percent to cater for growth in the poultry industry. In 1993 production was about 2.8 Mt, or about 57.9 percent of capacity (Table 61). Low levels of capacity utilization seems to be a feature of the feed industry. Simatupang and Pakpahan (nd) say that the protection of the feed industry and the policy of import substitution has resulted in an excessively large and highly capital intensive industry. They reported that in 1987, capacity utilization was only 18 percent.

The Indonesian poultry industry (as will be seen later, it is by far the major market for animal feed) has been facing competition from imported poultry meat. For small producers, operating with slim profit margins, the competition faced by the domestic poultry industry has reduced their marketing opportunities (PT Data Consult Inc., 1995).

Table 61. Production of animal feed components

Year	Production (Mt/year)
1989	2.0
1990	2.6
1991	2.6
1992	2.9
1993	2.8

Source: PT Ekamasni Consulting (1995)

There has been a high level of investment in the animal feed component industry. Between 1992 and 1994 (January to September), 18 new projects received permits from the Investment Coordinating Board. Of the 18 projects, 12 were new and six were for expanding existing plants. All of the new plants planned are for the fishmeal industry. Details of the applications are presented in Table 62 along with projected production of the industry to 2000.

Table 62. Projected capacity of the animal feed component industry

Year	Increase in capacity	Projected capacity (t/year)
1992	Nine new project planned to come into production in 1995 and one expansion of an existing plant	
1993	Three new projects scheduled to begin in 1995 or 1996. The capacity of these new plants is 111 200 t/year.	
1994	Three new plants and 2 plant expansions will increase capacity by 130 550 t/year	4 765 665
1995		5 007 456
1996		5 304 156
1997		5 370 206
1998		5 379 206
1999		5 379 206
2000		5 379 206

Source: PT Ekamasni Consulting (1995)

Animal feed mills

Indonesia has 158 feed mills with a capacity of 5.5 Mt per year. Not surprisingly, in light of the fact that most of the population and poultry industry are located on Java island, the feed mills are also concentrated on Java. Table 63 contains information on the production capacity of Indonesia's feed mills.

Table 63. Production capacity of feed mills

Province	Number of mills	Production capacity (t/year)
DI Aceh	2	9 360
Northern Sumatra	29	64 6 386
Western Sumatra	1	220
Riau	3	24 920
Jambi	1	48
South Sumatra	3	11 600
Bengkulu	1	3 600
Lampung	7	194 800
Sumatra	47	890 934
DKI Jakarta	9	484 100
West Java	48	2 004 835
DI Yogyakarta	2	36 250
Central Java	5	262 600
East Java	21	1 567 350
Java	90	4 355 135
Bali	6	4 943
West Kalimantan	2	78 000
East Kalimantan	1	15 000
Kalimantan	3	93 000
West Sulawesi	2	53 760
South Sulawesi	8	131 800
South East Sulawesi	1	900
Sulawesi	12	186 460
Indonesia	158	5 530 472

Source: PT Ekamasni Consulting (1995)

Fourteen of the animal feed producers are integrated with the producers of animal feed components. The feed producing industry is very concentrated, with the production capacity of the largest firm (PT Charoen Pokphand Indonesia) accounting for almost 20 percent of the capacity of the entire industry (Table 64).

Table 64. Major companies in the animal feed mill industry and their production capacity, 1994

Company	Type of venture	Location of feedmills	Production capacity (t/year)
PT Charoen Pokphand Indonesia	Foreign investment scheme	Medan, Jakarta, Surabaya, Tangerang	1 000 000
PT Japfa Comfeed Indonesia	Domestic investment scheme	Tangerang, Cirebon, Sidoarjo, Medan, Lampung	650 000
PT Cargill Indonesia	Foreign investment scheme	Bogor, Semarang, Surabaya, Ujung Pandang	220 000
PT Buana Superior Feedmill	Domestic investment scheme	Bekasi	201 600
PT Gold Coin Indonesia	Foreign investment scheme	Bekasi, Medan, Surabaya	200 000
PT Bulan Tatapurna Feedmill	Domestic investment scheme	Tangarang	200 000

Source: PT Ekamasni Consulting (1995)

The majority (55 percent) of the feed mills are small operations, with annual capacity of less than 10 000 t per year. This may be seen from Table 65. Not all of the smaller plants operate every day.

Table 65. Distribution of feed mills by capacity, 1994

Production capacity (t/year)	Number	Percentage ^a
over 200 000	6	3.8
100 000 to 200 000	7	4.4
50 000 to 100 000	10	6.3
25 000 to 50 000	17	10.7
10 000 to 25 000	31	19.6
under 10 000	87	55.1
Total	158	100.0

Note: ^a column may not sum to 100 due to rounding

Source: PT Ekamasni Consulting (1995)

The total production of animal feed in 1993 was 2 383 673 t or about 45 percent of capacity. A 1993 survey found that of the 142 companies in animal feed production, only 68 operated continuously. The 1993 production was about 600 000 t above the 1989 level (Table 65). Of the 1993 production, 87.5 percent was used for the poultry industry, 10 percent for shrimp and fish, and 2.5 percent for cattle, pigs, sheep and other four legged animals.

Table 66. Production of animal feed

Year	Production (t)
1989	1 721 020
1990	1 855 259
1991	1 911 091
1992	2 122 414
1993	2 383 673

Source: PT Ekamasni Consulting (1995)

According to PT Ekamasni Consulting (1995), competition in the industry is tight, with the largest three companies in 1993 producing 39 percent of total production (Table 67).

Table 67. Major companies in the Indonesian feed industry, 1993

Company	Production (000t)	Share (%)
PT Charoen Pokphand Indonesia	730	30.6
PT Central Proteinaprima	161	6.8
PT Central Pangan Pertiwi	40	1.7
PT Anwar Sierad	50	2.1
Others	1 403	58.8
Total	2 384	100.0

Source: PT Ekamasni Consulting (1995)

As was the case for the animal feed component industry, a number of expansion plans have been made. These are shown in Table 68.

Table 68. New and expanded production facilities, Indonesia

Year	Type of project	Number of projects	Comment
1992	New	5	These projects were due for completion in 1995 and 1996. Capacity will expand by 527400 t The projects were scheduled to be completed in 1995 and 1996. One was for shrimp and the others for animals.
	Expansions	4	
1993	New	3	These projects were planned for completion in 1996 and 1997. They will add 395200 t to production capacity. Projects are divided equally between animals and shrimp.
	Expansions	2	
1994	New	5	Cattle feed production will expand by 487000 t with the completion of two of the 16 plants. One poultry feed factory will expand capacity by 180 000 t. Completion of all 16 facilities will increase production capacity by 3609500 t. The new and/or expanded plants will be operating by 1997.
	Expansions	11	

Source: PT Ekamasni Consulting (1995)

With the new and expanded plants, production capacity will expand to just over 10 200 000 t by 1997 (Table 69). Only moderate increases over this 1997 level are planned for 2000.

Table 69. Production capacity in the Indonesian animal feed industry, 1994 to 2000

Year	Production capacity (t/year)
1994	5 530 472
1995	5 933 872
1996	7 720 272
1997	10 275 772
1998	10 538 572
1999	10 538 572
2000	10 538 572

Source: PT Ekamasni Consulting (1995)

The production of broilers has underpinned the expansion in the feed industry. Deregulation of the Indonesian economy in 1991 encouraged investment in poultry. Partly as a result, broiler production increased from 262.9 million birds in 1989 to 541 million birds in 1993. Table 70 shows the distribution of animal feeds between poultry, four footed animals and fisheries. Data for 1994 published by PT Data Consult Inc. (1995) tell the same story. According to their figures, poultry accounted for 86 percent of animal feed consumption, pigs 4.6 percent and other livestock the balance of 9.4 percent.

Table 70. Consumption of animal feeds, Indonesia

Year	Poultry (kt)	Four footed animals (kt)	Fisheries (kt)
1989	1 431.3	69.4	163.8
1990	1 619.4	103.1	185.3
1991	1 569.9	134.1	184.2
1992	1 774.6	107.2	205.8
1993	2 062.6	121.1	183.1

Source: PT Ekamasni Consulting (1995)

Between 1989 and 1993, Indonesia was a very modest net exporter of animal feeds, as Table 71 shows

Table 71. Consumption, production and trade in animal feeds, Indonesia

Year	Production (kt)	Imports (kt)	Exports (kt)	Consumption (kt)
1989	1721.0	114.1	170.6	1664.5
1990	1855.3	123.2	70.7	1907.8
1991	1911.1	120.3	143.2	1888.2
1992	2122.4	76.9	111.7	1087.6
1993	2383.7	87.2	103.5	2367.4

Source: PT Ekamasni Consulting (1995)

Animal feed is a key part of the cost structure of the animal industries. For broilers, it represents about 65 percent of costs. Day-old chicks represent about 25 percent of costs, while other operating expenses make up the balance. Broiler production profitability also depends on animal feed. When the birds are being maintained, feed is 84 percent of costs, and this falls to 76 percent when the broilers are fully in production (Table 72).

Table 72. Share of animal feeds in the cost structure of the poultry industry

Item	Share (%)
Cost structure of broilers	
animal feed	65
day-old chicks	25
operating costs	10
Cost structure of layers	
animal feed maintenance	84
animal feed production	76
day-old chicks	5
operating costs	11 to 19

Source: PT Ekamasni Consulting (1995)

Table 73. Projected consumption of animal feed

Year	Poultry (kt)	Four footed (kt)	Fisheries (kt)
1994	2 362.2	147.0	255.9
1995	2 667.5	169.1	294.6
1996	3 067.6	194.1	338.5
1997	3 527.8	223.6	389.2
1998	4 057.6	257.1	447.6
1999	4 665.5	295.7	514.7
2000	5 365.3	340.1	591.9

Source: PT Ekamasni Consulting (1995)

Table 74. Projected production of animal feed

Year	Existing capacity (kt)	Expected capacity (kt)	New capacity (kt)	Total (kt)
1994	2765.2			2765.2
1995	2765.2	143	18.4	2926.6
1996	2765.2	809.1	147.5	3721.8
1997	2765.2	1989.0	427.7	5181.9
1998	2765.2	2727.9	702.9	6195.8
1999	2765.2	3282.0	891.0	6938.2
2000	2765.2	3484.8	995.8	7245.8

Source: PT Ekamasni Consulting (1995)

Table 75. Projected livestock population

Year	Poultry (000)	Four footed animals	Fisheries (kt)
1994	1 003 247	43 591	3 856
1995	1 097 272	44 732	4 116
1996	1 204 618	45 907	4 272
1997	1 328 629	47 118	4 501
1998	1 457 476	48 364	4 745

Source: PT Ekamasni Consulting (1995)

The prospects for the animal feed industry in Indonesia are, in the opinion of PT Data Consult Inc. (1995), somewhat mixed. The livestock industry, particularly the poultry industry, has a positive outlook. This should mean increased demand for feeds. However, the tightness of the market indicates that only the integrated producers such as PT Japfa Comfeed, Charoen Pokphand, Anwar Sierad and Cipendawa Farm Enterprise, will be able to survive. Whether this is still the case in light of the situation facing Indonesia in the early part of 1998 is uncertain.

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