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# Livestock Industries of Indonesia prior to the Asian Financial Crisis

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

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Agriculture in developing countries like Indonesia will play an important role in preventing food shortage and producing raw materials for industrial purposes. On 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, in order to 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 role of genetics, nutrition and disease control are incomplete unless due consideration is given to economical 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 taken into account 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 market 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, focussing 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) levels.

- Integration of livestock into farming systems in Indonesia

- Identification of priority areas and institutional reforms for consideration by those involved in technical assistance project concepts 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
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for Asia and the Pacific

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

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*Kampung* chickens are raised using traditional production techniques by almost every household in the village. They are a side-line activity and are not considered the main source of family earnings. The members of the family are generally working in crop cultivation, as labourers, or as traders. Although some families keep more than 1000 birds, they still work in other activities for their main livelihood. In some cases, farmers have integrated their native chicken operations with fresh water fish farming by constructing the cages above the fish pond. This enables the fish to utilise chicken feed and manure for feed. While the utilising of manure for organic fertilisers is a common practice, it is rarely collected in the small-holder farms. Significant amounts of manure are collected on the large farms, and this can become a source of revenue for the farmer.

*Kampung* chicken 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 due to their low production. *Kampung* chicken do 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 one to another.

Apart from the *kampung* chicken, there are other breeds of native chicken that have been commonly regarded as a local chicken in a specific area. Examples are *Pelung* chicken, a large singing cockerel that originated in West Java; *Kedu,* a high egg producer from Central Java; and *Nunukan,* a breed claimed to be originated from 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 *kampung* chicken, in its conservation program.

## STATISTIC 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* chicken of all ages was 201 million birds; by 1996, their numbers had increased to almost 260 million birds, or by approximately 29 per cent. *Kampung* chickens numbers are concentrated in Java island, with about 43 per cent of the population being found here. 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 K*ampung* chickens in Indonesia.**

| | Number of *kampung* chickens | | | | | | | Change per year |
|---|---|---|---|---|---|---|---|---|
| Region | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | % |
| | (million) | (million) | (million) | (million) | (million) | (million) | (million) | |
| Sumatera | 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 | 111.80 | 118.82 | 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 | 201.37 | 208.97 | 222.53 | 222.89 | 229.91 | 250.08 | 259.87 | 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 per person per year of meat was consumed by the medium and low income groups, respectively. Further, it was found that the consumption of meat from improved chicken was 2.55 per person per year for the high-income group compared to the villages where only 0.74 kg. per person per year was eaten.

The direction of 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* chicken 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 10 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 since 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 program for *kampung* chickens. Since the 1980s, some 3000 to 6000 *kampung* chickens were 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 program each year. For example, the local government of West Java introduced two projects in 1995 involving 7000 mature *kampung* chicken for an intensive farming system program involving two groups of farmers in two districts. During the same year, in South Sulawesi, 6000 mature chickens were distributed to 60 households. If this program 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 program with 1.62 million birds being allocated to these farmers. In such a case, only 0.6 per cent 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 small-holders with less than 10 birds per household.

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

## GOVERNMENT POLICIES

The government introduced a program called INTAB (intensification of *kampung* chicken) in the 1980s, targeting groups of farmers who cooperatively 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* chickens 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. Technical supervision was also provided by the local government during the project term, 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 securing 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 improved poultry industry has led to the intensification of *kampung* chicken and this should assist the industry to continue to exist and to expand.

Following the INTAB program, another program called INVAK was introduced to vaccinate *kampung* chicken against ND. This program has led the farmers to understand that ND can be prevented by using an injection, or an eye or nose drop vaccine. However, the program is not able to cover all *kampung* chicken reared under the traditional system, even though the vaccine has been widely available throughout Indonesia from poultry shops. (It will be recalled the number of poultry shops has been increasing.) In practice, vaccination against ND for scavenging chickens is difficult. 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 given orally through chicken feed and/or laterally as a contact transmission (Darminto, 1995). The results indicated that vaccination in the scavenging *kampung* chickens did 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 area with insufficient facilities, the program 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 program called "Pengembangan Peternakan Rakyat Terpadu Berorientasi Agribisnis" or Integrated *Kampung* Chicken Industry (Diwyanto *et al*, 1996). The program has an agribusiness orientation and is a continuation of the INTAB program. Cooperators in this program 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 program is expected to increase the population of *kampung* chickens and to eventually increase farmers' incomes.

## RECENT AND PREDICTED CHANGES OF MARKET/INDUSTRY SIZE

As mentioned above, the *kampung* chicken industry has been limited to small holders 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 the productivity of *kampung* chicken is lower and has 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 K*ampung* 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

There are three *kampung* chicken farming system currently being practiced. A traditional farming system with a small number of chickens is common for most families in the village. 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 chicks are raised for three months. Loss of young chickens can be high, sometimes reaching 100 per cent. 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 vaccinating them. As well, young chicks are given two weeks on full feeding after

separation from the hen. The number of birds kept might be as high as 50. The chickens are usually allowed to scavenge in the backyard or in the garden after morning feeding and will then be 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, where *kampung* chickens are kept in cages with a full feeding program throughout the production period. This system is the outcome of the Government program 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. 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 as yet, since it requires skill and more investment for breeding, hatching and keeping young chickens to market weight. A government program 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 six square meters of land with 10 mature hens and 2 mature cockerels being mated. Eggs were collected and incubated. Since this ranch system was found to be not efficient, 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 program seemed to work and was explained to the extension officers of the Livestock District Office. However, the success of the AI program has not been evaluated as yet.

Little labour is required for the traditional system, since the farmers are not using *kampung* chickens as the main income source. ND control with the assistance of the government could improve the traditional small-holder system. The semi intensive system might also be improved by increasing the skills of farmers, through the provision of credit, and through the creation of a reliable market. With regard to the intensive system, it could be developed by increasing the numbers of birds kept and by providing inputs and outputs facilities close to the area where development of the industry is planned. However, the production of young chicks by the industry has not been sufficient and this is a major constraint facing the *kampung* chicken farming system.

On the other hand, feed cost 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 *kampung* chicken in meat and eggs production 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 program. Table 1.3 shows the performance of *kampung* chicken.

**Table 1.3 The biological performance of *Kampung* chicken kept under intensive management**

| Production stages | Body weight | Feed consumption | Others |
|---|---|---|---|
| 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 were no higher than 9 per cent.

Dressing percentages at 12 weeks of age are about 63 per cent of live weight, with a very low abdominal fat pad (0.82 per cent of live weight). Culling age depends on market demand with 750 to 1000 g live weight 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 per cent, 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 egg of *kampung* chicken, 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 per cent abdominal fat, 1.3 per cent breast fat, 6.8 per cent thigh fat and 34.2 per cent skin fat) compared to *kampung* chicken (about 0.82 per cent abdominal fat, 0.8 per cent breast fat, 4.4 per cent thigh fat and 21.6 per cent skin fat) (Triyantini *et al,* 1997). *Kampung* chickens have provided the meat ingredients for certain famous delicatessen such as "*Mrs. Suharti Fried Chicken,* and many *"Padang-Restaurants"* fried and casserole chickens. Meat preference

tests, which were based on the standard of table meat quality by the Department of Trade, showed that *kampung* chicken reached the value of 80 per cent compared to improved chicken which had a value of 53.3 per cent. Meat texture and thickness 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 egg from *kampung* chicken 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 5500 per kg in North Sulawesi while the lowest price was Rp 2000 in West Kalimantan. In Jakarta, the price was about Rp 2576. At the same time, *kampung* chickens reached a high price of about Rp 9000 per kg live weight in Maluku. The lowest price of about Rp 4600 was recorded in West Nusa Tenggara, while in Jakarta it was Rp 8000 per kg live weight. Such price differences will certainly encourage the national *kampung* chicken industry to develop, but it will not be able 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* egg will have 24 to 25 eggs and will sell for Rp 10000. Eggs from improved layers sell for about Rp 5500 per kg.

Action has to be taken for the future development of the *kampung* chicken industry. It can make a great contribution in 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 cooperation units, will contribute significantly to the industry.

Furthermore, research on native poultry has to 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 immediate high production, RIAP has set up research on crossbreeding *kampung* chicken with *Pelung* chicken for meat production, without ruining the genuine meat quality. Another experiment has also been undertaken to cross the native sires to improved layers in order to speed up F1 multiplication and growth rate. However, the end result was a bird with low consumer acceptance. Despite this set back, 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, along with finding some cheap unconventional feeds. The possible use and improvement of agricultural waste products such coconut meal, cassava, the sludge of oil palm, palm kernel meal, and cocoa waste product needs to be further investigated as a possible input into the chicken feed industry. 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 household in the village 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 programs that are economically profitable, socially acceptable and environmentally sound. The price of meat and eggs of *Kampung* chicken in the market is much higher than that of hybrid chicken. This provides the industry with an important advantage and is the reason for the promise of the industry.

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

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The concept of the partnership model under a Nucleus Smallholder Scheme (Pola Intirakyat) in the beef cattle industry, was inspired by a successful similar program in the estate crop sub-sector. The main objective of the program is to minimise 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 program to develop agribusiness in villages, is considered very promising to farmers in many aspects of life.

The concept of PIR has attracted government attention since there has been competition between the subsistence farmers and large scale enterprises in producing and marketing of final products. The bargaining position of subsistence farmers is very weak since they can not guarantee product supply. This weakness could be reduced if subsistence farmers could organise themselves under a cooperative 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 village. As results, it is also expected that farmers, through development under the program could become the backbone of 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 program in Indonesia. Therefore, it is expected that given the opportunity, the economic development of the village could improve since the type and characteristic of this business is closely linked to the farmers daily life.

Sukartawi (1994) shows that there has been excellent growth in the estate crop, livestock and fisheries sub-sectors, reaching 5 to 6 per cent per year. This development gave an incentive to the government to further develop these sub-sectors. However, there are also negative issues that can hamper the approach. Simatupang *et al.* (1995) reported that any report that focused on

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

The role of the village cooperative unit (Koperasi Unit Desa, KUD) as a motivator and an agent for farmers should be more pro-active in planning and implementing the program. 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 between both parties are prevented.

## DEVELOPMENT OF CATTLE FEEDLOT INDUSTRY AND PRODUCTION CAPACITY

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

**Table 2.1 Demand and supply for beef products, 1995 – 1997**

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

Source: APFINDO (1997)

In 1997, 358,000 tons out of 468,000 tonnes 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 tonnes and another 30,000 tons 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 per cent annually, while the demand for beef is likely to increase by up to 8 per cent 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, the number of cattle feedlot companies located in Lampung, West Java and Central Java was only five. 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 feedlot increased to 41 companies distributed in 13 provinces. All cattle feedlot companies in

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

Sitepu *et al.* (1996) also reported from a survey of 14 cattle feedlots production capacity of these feedlots varied between 1,000 and 60,000 heads per year. Most of the cattle feedlot operation used 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 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 in 1991 to 367,000 head 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 | 1,063,374 |

Source: APFINDO (1997)

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

## DEVELOPMENT OF CATTLE FEEDLOT UNDER 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 to assist farmers is indicated by the willingness of farmers to join the scheme. The farmers 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 days quarantine period and a 60 days 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) carried out the nucleus scheme, with available pineapple waste sufficient to feed 7,000 head of cattle year around. This means that 21,000 heads of cattle could be fattened each year, in three periods of four months. Apparently, the company only raises 2,400 head of cattle. Hence, 18,600 head could in theory be raised by farmers. The GGLC established two kinds of nucleus scheme, namely a "credit PIR" and a "self-supporting PIR" (SS-PIR)

The credit PIR scheme has been used since 1989 with an initial number of cattle of 20 head distributed to 20 farmers. Thus, each farmer received one head of cattle. An economical farm

size demands a certain number of cattle be raised by each farmer. In 1991 the company, PT GGLC, developed a cooperative arrangement with the KUD as the organiser 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 2,320 head of cattle, which was far below the target. In the five years 1991 to 1995, the number of animals in each farmer's package was increased to three head of cattle 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 at the beginning only included 20 farmers. The difference between the two kinds of PIR lies in the provision of capital, which in the SS-PIR is provided by the farmers themselves, while the supply of raw materials was provided by the company. The average farm size was seven head of cattle per farmer, for a six month fattening period.

The feed, in the form of pineapple waste, was 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 the implementation of 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 program both parties would sign a contract or memorandum of understanding (MOU). In the MOU, it was specified that the farmer, as a member of the KUD, provide corn forage (72 days corn plant), animal pens and labour. The MOU required that the company 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 plantation program to make corn silage. The Company provides inputs such as corn seed, fertiliser and technical supervision, while the farmers provide land and labour. At the end of 72 to 75 days period, the farmers sell the corn plant 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 specialising in fattening Bali cattle with an initial body weight of less then 200 kg. Production capacity of 2,400 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 program showed good productive performance as indicated by an increase in the cattle population of around 38 per cent per year. Also, the number of farmers involved in this program increased by about 31 per cent per year. However, in 1988, the productive performance declined due 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 farmer dropped by 69 per cent per year and the number of farmers involved also declined by 66 per cent per year. According to Simatupang *et al.* (1995), this drastic reduction resulted in a change in local income and the policy resulted in an uncertain supply of feeder cattle from the nucleus company to the farmers. At the beginning of the scheme, transportation of feeder cattle was done by the company. However, due to a change in

management policy, the transportation of feeder steers was carried out by the Indonesian Animal and Product Trade Association (INDAPTA) which charged a fee.

A nucleus scheme in Lombok (West Nusa Tenggara) was carried out 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 raises the cattle to a certain body weight (300 kg). To achieve the desired body weight target, farmers raise cattle about 4 to 8 months, depending on the condition of the animals when they arrive in farmers place (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 one 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 per cent of imported cattle has to be distributed to local farmers under the nucleus smallholder scheme (PIR). The objectives of this program are:

- to give a chance for the local farmers to increase their income
- to improve the capability and skill of the farmers in small scale cattle feedlot management
- to stimulate the activities of villages towards 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 Service, instructed all cattle feedlot companies in Indonesia using imported feeder cattle to increase the proportion of their nucleus smallholder scheme with local farmers from 10 per cent to 20 per cent of the total imported feeder steers. This scheme has to be followed by both cattle feedlot with foreign investment (PMA) and domestic investment (PMDN). In addition to this, the government also introduced a nucleus smallholder scheme for cattle breeding in order to produce calves or feeder cattle, and to substitute these for imported feeder cattle.

The nucleus scheme as a business based in the agricultural sector, should be considered to be a system where each party has 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.

The linkage analysis was done by separating the inputs and the outputs. The coefficient of forward linkage for the livestock sub-sector, especially ruminant, was more than one (1.108), while the coefficient of backward linkage was 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 was different from the feed industries as the coefficient of forward linkage was smaller than that of backward linkage (0.766 versus 1.158). The implication is that the product was not delivered directly to the consumer but to other down-stream industries (Sukartawi, 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,

farmers did not make any profit because they did not receive the feed they needed since the feed was used by 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 vs 0.768). The arrangement was therefore apparently beneficial for both up-stream and down-stream industries (Sukartawi, 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 in the difference between the price of output in the country and the import price of the same commodity. The nominal protection for milk at the consumer level at the time of their study was 32 per cent. This shows that domestic consumers paid more than would have been paid without protection at the farmer level. At the industry level, the nominal protection was 38 per cent. In the credit PIR, farmers with less than four head received the smallest nominal protection (only 24 per cent) while farmers with seven to 10 head received 34 per cent. Those farmers with at least 13 lactating cows received 38 per cent.

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

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 consumer 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 done in the PIR program has not been evaluated yet. With the coming free market and globalisation era, it is hoped that all policies can be reevaluated.

In the last few years of implementation of the nucleus smallholder scheme 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 nucleus smallholder scheme
- 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, as the major restriction in supplying roughage for cattle feed, and
- the distance separating the cattle feedlot company and the animal pens set up by farmers increases operating cost during the fattening period.

Additionally, the limited education and capability of those in all parts of the nucleus scheme in the beef cattle industry will hamper the adoption of new technology and management and limit their ability to make use of information. These factors, in turn, will limit the ability of scheme participants to do business. Therefore, the smallholder farmers require guidance for success in the nucleus scheme. The concept of guiding has to be able to accommodate all levels of the

nucleus scheme. At the farmer level, guidance should be given as to how to increase the scale of operation. For problems related to husbandry, product quality, marketing, investment and management should be stressed so that farmer become aware of the economic aspect of the business.

## FINANCIAL PERFORMANCE OF THE NUCLEUS SCHEME

As the nature of nucleus schemes (PIR) being implemented in villages varies greatly, there is a need to evaluate the financial performance of the nucleus scheme (PIR). An analysis of the financial performance of the nucleus schemes (PIR) 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 mix 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 per cent of body weight. Concentrate and pineapple waste were mixed together before being offered to the animal and feed was offered one or two times a day. Each cattle received 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 SS-PIR spent Rp 6,580,120 per farmer per period. Apparently 77 or 78 per cent of this total production cost was for buying the feeder cattle. The second largest part of the total cost (12.1 per cent) was the feed component for both credit PIR and SS-PIR. Expenses for concentrate dominated the variable cost (6.8 per cent for SS-PIR and 7.4 per cent for the credit PIR), while cost for pineapple waste reached 5.3 per cent at SS-PIR and 4.7 per cent for credited 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 the farmer of credit PIR Rp 984,328 per head per period. The profit relates to the situation where SS-PIR farmers bought the feeder cattle themselves while the credit PIR farmers earned less profit as 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 SS-PIR and credit PIR. Farmers in the SS-PIR scheme sold cattle at a higher price of Rp 2,650 to 3,000 per kg of body weight while farmers in the credit PIR scheme sold cattle at Rp 2,500 to 2,800 per kg body weight (Santoso *et al.,* 1995).

For the nucleus scheme (PIR) of PT TIPPINDO, 90 per cent 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 is 12,000 heads and it is targeted to market 100 head per day. The fattening period is between 74 and 90 days with a quarantine period of two weeks. Green corn forages was given *ad lib*, and the forage originated from the nucleus scheme on 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 program was up to 0.8 to 1.2 kg per head per day.

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

## CONCLUDING COMMENTS

The nucleus smallholder scheme (PIR) between the nucleus (company) and farmers in the villages has a variety of forms, related to the economic, social and cultural condition of the farmer. The advantage of the nucleus scheme for beef cattle (PIR) is the positive impact of making better use of available resources for the production of beef cattle. On the other hand, the negative side of this program is the sharing of 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

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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 nongovernmental organisations. The purpose of reporting this information is to assist policy makers in the industry 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 three to four 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 program 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, 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. In order to improve competitiveness, it is important that there be some general consensus as to what the problem areas are for the industry. In this way, government and industry will be able to formulate programs 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. These are a survey of dairy farmers and co-operatives, a questionnaire presented to high level officials connected with the dairy industry and finally 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 a similar smallholder dairy industry, namely that 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 Approach (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<br>Lack of water<br>Quality of concentrates<br>Nutritional management |
| Herd record keeping | Low level of herd improvement<br>Non identification of animal health problems<br>Poor reproductive performance |
| Hygiene | Lack of water<br>Increase in mastitis incidence<br>High level of milk contamination |
| Milk testing | No clear price signals to farmers |
| Animal health | Many diseases<br>Lack of resources for veterinary staff<br>Lack of experience and education |
| Genetics | Inappropriate genotype for Indonesian conditions<br>Long calving intervals |
| Extension provision | Lack of resources to train/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 (1983) have estimated that daily water requirements for dairy cattle in the tropics are around 13 percent of body weight. For average Indonesian dairy farms this equates to a requirement of around 50 litres 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 around farmers who have had little or no prior experience in livestock management. Once they are

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 neither a reflection of a lack of personnel (de Haan [1989] has estimated that there are at least 29,000 extension workers in Indonesia) or a lack of ability on the part of workers. The main reason for lack of adequate extension services appears to be 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 program undertaken in 1992 with six Javanese dairy co-operatives, improvements in technique of over 50 per cent were achieved after only two extension visits at each co-operative. This can be compared with average improvements in technique reported by Chamala (1993) in South East Asia as a result of different method of extension delivery. These ranged from a low of 19 per cent for indirect influence to a high of 33 per cent for group sessions.

## WEAKNESSES AS IDENTIFIED BY THE DIRECTORATE GENERAL OF LIVESTOCK SERVICES

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

- Feeding management/quality
- Reproduction problems/long calving intervals
- Mastitis
- Quality of milk
- Farm management

The Directorate General of Livestock Services 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 summarised in Table 3.2.

[1] Imported heifers at the time of the survey cost approximately $A2000 (Rp 3,700,000), or roughly three times the average annual income in Indonesia. It is worthwhile noting that 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<br>Lack of expertise<br>Incorrect drug application |
| Dairy cattle | High calf mortality<br>Reproductive disorders<br>Mastitis<br>Brucellosis<br>Tuberculosis<br>High calving interval<br>High services per conception |
| Animal nutrition | Pesticide residues<br>Lack of available land<br>Seasonal nature of feed production |
| Milk processing | Poor quality of milk<br>Lack of technology applicable to the village |
| Marketing systems | Highly variable price<br>Dependence on IPS |

Source: DGLS (West Java), (1996).

The conclusion reached by the Directorate General of Livestock Services 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 sector.

## 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 organisations 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 thought the strengths and weaknesses of the Indonesian dairy industry were, and their opinions on the major problems facing the dairy industry. Table 3.3 and Table 3.4 show the respondents' opinions on the problems faced by the industry and the industry's 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 | 3 |
| | 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 | 2 |
| | 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 are 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 group of 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 under 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 combined with income growth Indonesia is likely to experience in the future 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 to compare with the Indonesian experience due to a number of similarities between the two industries.

Both industries are based upon the use of temperate breed cattle in the tropics (Fresian and Jersey); both are based on confined rearing, herd sizes are similar, climatic conditions are somewhat similar; and both industries have been faced with productivity and quality problems.

Kadzere (1992) uses data gathered in a survey of 36 dairy farms in Zimbabwe and South Africa and assesses the major problems faced by the participants. The results are summarised 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<br>Need to develop appropriate characteristics based on criteria of Vissac(1976) |
| Nutrition | Seasonal nature of forage production<br>Poor nutritional quality of available forage<br>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 level of capital requirements 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 contemplating the design of programs and policies aimed at bringing about improvements to 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 level[2]. In this way, effective policies

[2] Some areas identified by seminar participants as important for future research assistance are listed below.

identifying appropriate extension strategies
dairy product marketing
appropriate on-farm technology

and advice can be designed for the industry. Any assistance given should conform with the view of Wilson et al (1992). Briefly they proposed that solutions have a high likelihood of sustainability; reach the participants who are most in need; uses local knowledge; and are 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 programs 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 be more a reflection of the affiliation of the respondents with the dairy industry rather than this particular issue not being important.

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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

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The development of the agricultural sector in Indonesia is expected to enter into the industrialisation era, where the production of livestock is projected to be a new area of growth. The development approach and orientation is a major shift from production to income generating and from a commodity 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 focus is on more efficient utilisation of natural resources for a sustainable environment and is aimed at increasing farmer's welfare. With the economic problems that have been facing Indonesia, an approach based upon taking advantage of locally available resources is re-emphasised since 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 temperature ranging between 23 to 31$^{o}$C in the low plains and 18 to 27$^{o}$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 reached 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 systems based on production systems such as rice-rice-rice or rice-secondary crop-rice in the one year, one would expect that there is 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 5600 km from east to west and 1600 km from north to south, has a total land area of around 1.91 million km$^2$. The major islands are Sumatera, Kalimantan, Java, Sulawesi, the Nusa Tenggara Islands, Maluku and Irian Jaya. Of these, Kalimantan is the largest, with about 28 per cent of the total land area.

The island of Java is relatively small (6 to 7 per cent 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 population represent 70 to 80 per cent of the national livestock population that are raised in a traditional small scale production systems with three to four animals per farm. The animals are generally kept in barns and the income of livestock production provides less than 30 per cent 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 reached 10,000 to 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 to 80 per cent) 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 fish meal, 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 these were severely hit by the economic crisis. Similarly, the demand for milk has increased dramatically, but 60 per cent 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 members of dairy co-operatives. Average production is 8 to 12 litres 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 has moved towards a mere 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 where 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 lack of improvement of productivity and the low quality of forage is a major limitation as the animals are grazed on communal grazing lands. The introduction of improved management practices and the utilisation of improved grass and legume species have had has little success with the uncertain management system. Individual farmers do not feel responsible for the management of the grassland areas.

In Sumatera and Kalimantan, thousands of hectares of land area 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 Sumatera 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, shortages 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 crop | 11,368,507 |
| Grasslands | 1,889,399 |
| Ponds | 604,720 |
| Fallow land | 6,967,938 |
| Wood land | 9,555,010 |
| Estates Crop | 13,835,746 |
| Irrigated rice fields | 8,484,687 |

Source: BPS (1996)

## LOCALLY PRODUCED FEED AND ON FARM PROCESSING

In the subsistence traditional systems, feed for animals is not a particular activity and it is the ability of the farmer to obtain feed that determines the amount of feed available. This has limited the number of farm animals raised by farmers who do not follow any feeding standards. Farmers are more often concerned with keeping the animals alive since they provide a source of income through the selling of the animals. The amount of feed offered does not take into account efficiency measures and depends heavily upon the available forage that grows naturally in the surrounding areas. Feed collected from surrounding areas is not of a guaranteed quality nor is continuity of supply guaranteed. Forage production for ruminant animals is not a common practice due to limitations in land ownership. 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 that can be fed to animals are already used and this is particularly apparent in densely populated areas with high stocking rates like Java. If materials are not fed to animals this is generally due to the distance between the supply area and where the animals are raised. Transportation of the material to where the animals are would result in a price that may not encourage its use by low income farmers. An exception is the use of rice straw in Gunung Kidul where 50 to 60 trucks loads are delivered to farmers (Diwyanto, personal communication).

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

**Table 4.2 Feed resources and utilisation**

| Name | Product | Utilisation | Availability* |
|---|---|---|---|
| Fibrous feeds | | | |
| Oryza sativa (Rice) | Straw | Fresh/dried<br>Stored for 3-4 months | 36,547,000 t. |
| | Bran | Fresh | |
| Manihot esculenta (Cassava) | Leaves | Fresh/wilted | 10,407,000 t. |
| | Stalks | Fresh/dried | |
| Zea maize (Corn) | Leaves | Fresh/dried | 5,275,000 t. |
| Saccharum officinarum (Sugar cane) | Tops /Leaves | Fresh, out ribbed | 83,800 ha |
| Napier grass | Leaves | Fresh | na |
| Native grass | Leaves | Fresh/dried | na |
| Musa paradisiaca (Banana) | Leaves | Fresh | |
| | Stem | Fresh | 2,192,060 t. |
| | Peelings | Fresh | |
| Carbohydrate Feeds | | | |
| Oryza sativa | Bran | Fresh | |
| | Broken rice | Fresh | |
| Manihot esculenta | Tuber | Dried | |
| Zea maize | Grain | Dried | |
| Saccharum officinarum | Molasses | Fresh | |
| Cocos nucifera (Coconut) | Cake | Stored | 3,246,200 ha |
| Leguminous feeds | | | |
| Leucaena leucocephala | Leaves | Fresh | na |
| Gliricidia sepium | Leaves | Wilted | na |
| Calliandra callothyrsus | Leaves | Fresh | na |
| Glycine maximum | Expeller | Stored | na |
| Sesbania sp. | Leaves | Fresh | na |
| Non-conventional feeds | | | |
| Hevea (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 indicates 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, feeding of rice straw as basal roughage require additional good quality feedstuff or concentrate feeds in order to gain 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 the high price at the farm level limits the use of these products by small holder farmers. While the production of forage is not a general practice, the feeding of concentrates to

animals is also not carried out except by dairy farmers and commercial feed lotters. Smallholder farmers generally do not have the financial capacity to feed concentrate to animals. Although the provision of good quality feed in sufficient amounts for optimal productivity is seen under the traditional livestock production systems, the availability of good quality feed is limited. Agricultural residues are only in abundance at harvest time, questioning the continuity of supply. The level of agricultural products collected by the smallholder farmer is 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. Feeding rice straw in certain regions in Java is already a common practice. 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) | (Kt/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 per cent of available residues, while sugar cane top, bagasse and maize products contribute less than 10 per cent. 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, since this is when farmers and plantation workers around the sugarcane plantations have access to the cane tops. Once these are taken from the field these are offered to the animals after the rinds have been removed. 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 although horses are an exception. The inclusion of molasses in the rations of animals is known to improve feed palatability, and to be a source of readily fermentable carbohydrate and sulphur in the making of urea molasses blocks. Molasses is a potential ingredient for feed pellets due to its binding properties. Up to 30 per cent 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 feedlotters and corn farmers have been set up and in these corn farmers supply corn stover to the feedlotters.

In the poultry business, the use of corn, soybean meal and fish meal as basic ingredients in the ration has been generally recommended, but this has resulted in a disaster with the high cost price 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 not feasible. The price ratio between feed and livestock products that was at one time favourable for livestock

producers has not been maintained. It has sometimes been the case that 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. A possible approach is the use of protein enrichment technology where cassava is used as a base material. Treatment of carbohydrate rich feed showed that it is possible to increase protein content from 3 to 4 per cent to 20 to 40 per cent in a solid state fermentation process using *Aspergillus niger* (Kompiang *et al*., 1994). Cassava is one of the richest starch producing plant 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 one million tonnes is exported despite the problems of fungal growth and cyanide content. The use of cassava chips in Indonesia has not been popular as 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. $T^2$ toxin can be detected in cassava chips at concentrations below the level of 0.32 to 0.64 mg per kg live weight and this is reported to cause enteritis to ruminants (Lynch, 1979). The leaves of cassava are already extensively used to feed animals and these are abundant at harvest time. Sudaryanto *et al.* (1983) investigated the method of harvesting of cassava leaves. It was found by leaving 15 leaves at the top part 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 to 17 per cent. 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. The use of byproducts from pineapple canning factories for feeding animals has occurred in Lampung. Residues from pineapple canning were 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-products that is of limited value for human consumption. It contains the aleuron layer, endosperm, scutellum and germs 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 per cent) protein level with a fat content of around 15 per cent. The limitation of using rice bran as a concentrate feed is that the high fat content causes rancidity as 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 are milled. Those rice farmers who have no animals leave the bran at the rice mill as part payment for the rice being milled.

Wheat byproducts, in the form of pollard and bran, are available and they 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. As only one company is involved in milling wheat, the quality of wheat pollard and bran is consistent.

Coconut meal is another byproduct 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 problem with coconut meal is the oil content which means it easily becomes rancid due to with the presence of mycotoxins. This no doubt lowers 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 of 25 per cent. The fat content is high – 8 to 10 per cent – and this is due to the poor extraction process. Kapok seed meal is believed to contain components that are toxic to monogastrics. Reportedly these are degraded in the rumen making them non-toxic to ruminants.

## PRETREATMENT OF FIBROUS AGRICULTURAL RESIDUES AND CONSTRAINTS TO ADOPTION BY FARMER

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. Presently, a problem is that livestock operations often have to be moved to other areas due to a change in land use priority setting. These include community development, food crop production and industrial crops.

Availability of agricultural residues such as corn stover, sugar cane tops and cassava leaves results a problem of continuous supply as these are only available during the harvest time which is often once a year. Storage of the material also creates problems due to space and transport limitations. Forage products that have a high moisture content (over 30 per cent) cannot be safely stored without special treatments. With the humid tropical conditions, spoilage due to microorganism is a problem. In the field, sun drying is common and inexpensive. However, the quality of the dried product is uncertain. In addition, during the rainy season, sun drying is not possible due to the uncertain rain pattern. In view of the variable agroecology and processing methods, the quality of agricultural residues varies widely and this will impose difficulties in formulating feed rations. The low protein and energy content associated with the use of fibrous agricultural residues require feeding of additional supplements. 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 like pressing, will assist in increasing 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 practiced by farmers (Ibrahim, 1983; Doyle *et al*., 1986). While it is evident that the technologies to improve straw quality have been successful in breaking the ligno-cellulose complexes, Djajanegara (1986) 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 to achieve 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 per cent 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 to preserve 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 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**.** Winugroho (1994) investigated the process for selection of microbial population that have adaptated to low quality fibrous substrates environments. Increased weight gain of cattle was reported by feeding 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 microbial treated rice straw involved a mixture of microbial compounds by one farmer in Central Java, (Suharto, 1997). The straw was treated under 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 agriculture residues include :

- the relatively small amount of straw collected to feed animals
- a lack of storage facilities
- the additional costs to treat the straw, and
- the necessity for a redrying process and a shortage of labour.

No storage facilities and labour shortages during harvest time are major reasons why only a small amount of straw is collected. At harvest, farmers are busy caring for the recently harvested rice. The production of rice by the small land owners does not encourage mechanisation as it will not be feasible for smallholders, most of whom are poor. It is also apparent that farmers prefer to feed their animals on the other feeds available, like fresh roadside grass, since this is more palatable than straw. The distance the straw has to be carried to the animals with the present infra-structure does not allow all available straw to be collected. Djajanegara (1981) reported that to collect one tonne of wet straw, which is a relatively small quantity, took nine mandays during the rice harvesting season.

Alternative uses of rice straw are probably more convenient. These include burning, which results in its use as a fertiliser 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 production 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 fibre source and construction materials; and fuel to produce heat. No data are available on the proportion of straw put to these uses.

One point to note is 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 was generally stored for three to six months. It is most probable that the nutritive value of the straw may have improved 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 becomes excellent grassland area for cattle, and it is generally the case the animals are in a better condition. Collection of forages could take place 10 to 20 km away from the farm, but the amount collected by one farmer in one day will only be sufficient to meet the animals' requirement 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 two 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 into the future, the opportunities to produce local feed ingredients in an agribusiness setting must be taken into account. Chances exist to produce complete mixed rations for ruminant animals that include the provision of fibrous feed materials in the ration. 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 as they also face the pressure of limited land resources. With regard to this, Indonesia has the land resources in less populated islands like Sumatera, Kalimantan and Irian Jaya. For small scale operations, under a co-operative scheme, the type of production scheme could be managed by co-operatives that are equipped with a small processing unit. Individual farmers, raising only a small number of cattle or sheep and goats, could join the farmer's co-operative in the distribution of the feed.

Of interest is the integrated production scheme in an *Integrated Livestock-Estate-Crop Production Systems* (ILEPS) approach. The vast plantation areas found in Indonesia, where the biomass growth under the estate trees provide excellent forage resources, has potential for such a scheme (Table 4.4).

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

| Crops | Large holder estate | | | Smallholder estate | |
|---|---|---|---|---|---|
| | Number | Planted area | Production | Planted area | Production |
| | | (000 ha) | (000 ha) | (000 ha) | (Kt) |
| Perennial Crops | | | | | |
| Rubber | 465 | 538.3 | 334.6 | 2942.0 | 1178.6 |
| Coconut | 265 | 137.6 | 52.8 | 3584.0 | 2651.2 |
| Oil Palm | 457 | 1146.3 | 2569.5 | 722.5 | 1105.9 |
| Coffee | 157 | 46.7 | 26.5 | 1099.7 | 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 | .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 | 2160.1 | | |
| Rami/Rosella | 13 | 6.9 | 4.9 | | |

Notes: 12% of land area can be utilised for grazing

Source: BPS (1996)

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 Sumatera where sheep are raised under rubber trees suggest this could also become a promising production systems. The animals could utilise the forage biomass that has been regarded as weeds by the plantation operations. This material is, in fact, 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 under growth, 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 per cent protein. When these are fed to cattle, the animals gained close to 900 gm per day. With the vast plantation areas, the scope for producing local feed material is wide open. For a feed mill operation, the problem of distribution may not present a big problem as long the selling price makes the approach viable for farmers. From the processing of estate crop products, residues such as palm kernel cake could also be fed to animals in limited amounts.

For the future, the utilisation 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. The importance of feeding good quality rations in sufficient amounts to farm animals is vital to achieve optimum production rates.

Over the centuries, small holder farmers have existed using feed materials found within the surrounding areas. That production systems could be regarded as a no cost feeding system. Hence, to compete with this type of production is very challenging. Almost all available feed materials have been used by small holder farmers. However, there will be changes with the increasing pressure to use land resources more efficiently. Farm animals need to have access

to a sufficient and continuously available feed supply if they are to obtain a reasonably high production performance.

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

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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 reflect an increasing demand for livestock product. Future demand for livestock products must be supplied through either domestic production or through imports. Small holders production alone can not be expected to meet demand, and alternative production system 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 system in the livestock industry. These include the transport of feedstuff 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/retail outlets. Since Indonesia is made up of more than 13,000 islands spanning about 5,000 km from east to west, information on inter island shipping of livestock will also be described.

## TRANSPORT OF FEEDSTUFF 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 per cent 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 presently located around five cities – Jakarta, Bandung, Semarang, Surabaya (all of these

cities are in Java) and Medan (in Sumatera). In 1996, the production of poultry feed had increased to 6.5 million tonnes, only to fall to 2.5 million tonnes in 1998 due to the economic crisis in Asia. About 60 per cent of corn, 90 per cent of fish meal and 100 per cent 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 Sumatera (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 Sumatera | 10 |
| South Sumatera | 1 |
| Lampung | 5 |
| South Sulawesi | 1 |
| Total | 63 |

In the past, the importing of soybean and fish meal 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 feedstuff, 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 were 830,000 tonnes, 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 to 60,000 tonne while the latter group have a capacity of about 25,000 to 30,000 tonne. 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 while Medan and Panjang (in Sumatera) are able to handle the small carriers. All of 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, P.T. Krakatau Steel. The port is used to unload feed grains, especially from large carriers with 60, 000 tonne capacity. Most ports operate year round, except for Cigading Port. The government has spent millions of rupiah to improve or upgrade the port facilities.

At present in Indonesia there is no port with facilities for automatic loading or unloading grains ("pelabuhan curah"), although ports do have crane facilities capable of unloading 50 kg bags of feedstuff. Animal feed on the ships is put into 50 kg bags on ship by laborers. They are unloaded using the port's crane facility and usually they are carried by trucks direct to the feed mill. For large feed mills, most corn and soybean is stored in upright silos. The cost for 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 value of quantity realisation of imported feed ingredients and the country of origin, 1997**

| Imported Feedstuff | Quantity | Value | Country of Origin |
|---|---|---|---|
| | (t.) | (US$000) | |
| Hydrolyzed Feather Meal (HFM) | 25,288 | 10,660.7 | Australia, USA, UK, Italy |
| Corn Gluten Meal (CGM) | 75,111 | 33,665.5 | India, USA, Australia |
| Meat Bone Meal (MBM) | 164,751 | 62,475.2 | NZ, Australia, USA, Italy, Peru, Can |
| Soya Bean Meal (SBM) | 829,930 | 259,527.4 | India, Brazil, Argentine, USA |
| Canola Meal Pellets (CMP) | 31,750 | 6,614.5 | Canada |
| Wheat Pollard/Bran (WP/B) | 63 | 37.8 | USA |
| Meat Meal (MM) | 6,280 | 2,596.2 | NZ, Peru, USA, Chile |
| Fish Meal (FM) | 48,686 | 31,526.6 | NZ, Peru, USA, Chile |
| Poultry By Product Meal (PBPM) | 18,792 | 8,757.1 | USA |
| Poultry Meat Meal (PMM) | 7,136 | 3,546.6 | UK |
| Defatted Meat Meal (DMM) | 2,450 | 1,065.6 | Italy, France |
| Rapeseed Meal Extract (PME) | 97,097 | 13,695.5 | India |
| Groundnut Meal Extract (GME) | 30,787 | 6,481.6 | India |
| SM.-300 | 36 | 29.9 | France |
| Yellow Maize/Corn (YM/C) | 79,007 | 14,344.5 | Argentine, China |
| Poultry Protein Meal (PPM) | 1,000 | 455.0 | USA |
| Vegetable Protein (VP) | 28 | 25.9 | USA |
| Squid Liver Powder (SQLP) | 149 | 63.8 | Australia, USA, South Korea |
| Canary Seed (CS) | 63,957 | 22,384.9 | Canada |
| Fish Oil (FO) | 36,713 | 23,083.3 | New Zealand, Peru |
| Hypro Soy Meal Pellet (HSM) | 63,000 | 21,152.3 | Argentina, Brazil |
| Brown Flax Seed (BFS) | 120 | 54.4 | Canada |
| Sesame Seed Meal (SSM) | 550 | 141.9 | India |
| Hypro Sunflower Seed Extr (HSSE) | 2,420 | 496.1 | Argentina |
| Scallop Liver Powder (SCLP) | 54 | 67.5 | Japan |
| Skimmed Milk Powder Replacer (SMPR) | 19 | 11.5 | Netherlands |
| Blood Meal (BM) | 160 | 640.0 | New Zealand |
| Oats | 9 | 2.2 | Australia |
| Feed Barley | 8 | 2.0 | Australia |
| Fish Soluble (FS) | 18 | 13.1 | Taiwan |
| Sunflower Meal (SFM) | 3,300 | 462.0 | India |
| Poultry Grease (PG) | 1,05 | 509.3 | USA |
| Soybean Lecithin (SL) | 15 | 12.8 | USA |
| Krill Meal (KM) | 5 | 8.0 | Ukraine |
| Rice Bran Extract (RBE) | 6,767 | 622.6 | India |
| Total | 1,596,506 | 525,256.6 | |

## 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 per cent 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 where the shipping of feed grains will be concentrated in the future, since facilities for the automatic loading and unloading of feed grains and silos will be available. When finished, it will be the only modern port for feed grains in Java. There are a series of government regulation 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 location of feed mills is usually in the area where port facilities are available for importing feed ingredients. In addition, the location of feed mill also considers the availability of local ingredients such as corn and rice bran since these might be the main ingredients for animal feed. About 50 per cent of feed ingredients comes from corn and about 10 to15 per cent 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 Sumatera, Bali, and Madura islands because of the relatively close distance 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 carrier usually carry timber from Kalimantan or Sulawesi to Java, and on the return trip they carry feedstuff for the poultry industry. In Java, 90 per cent of the feed ingredients are transported by truck, 10 per cent 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 produced by factories located near the feed mill, are collected by the feed mill using its transport equipment. Feed companies generally rent trucks to carry feed ingredients to the feed mill, as only about 5 per cent 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 size of trucks varies in capacity. Small trucks, with a capacity of 5 tonne (locally called Colt Diesel), bigger ones with 15 tonne capacity, or double trucks with a capacity of 30 tonne 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 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 kg 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. The charges for which the truck operator is responsible consist of the cost of a clearance permit and a fee (or "retribution") for the local government. Before the trucks can be operated, the owner must obtain a certificate of clearance from the office of the local road traffic authority (DLLAJR). They need also 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/improvement of roads in Indonesia is a government responsibility. For example, in Java where around 60 per cent of the population live, a higher priority is placed on road development than is the case for 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 island 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 the destination of the transported animals. 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 include Sumatera, 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/buffaloes to the slaughterhouse. "Fuso" trucks have a capacity of 13 to 15 head while "Colt Diesel" trucks carry seven to eight 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 traveled. Prior to their slaughter, the animals must be given a rest for at least 12 hours. There is no incentive paid to the truck drivers who deliver animals to the slaughterhouse with little or no bruising or no reduction in weight. However, the driver will be penalised 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 to minimise 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 minimized the movement of the animals. Small cattle traders usually don't have good facilities. Thus, for them, some bruising at times can not 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 animal have a suitable health certificate. When livestock are moved across borders, their owner has to pay a governmental fee that varies between locations. For example, at the West Java boundary the charge is Rp1,500 per head, while at the Lampung boundary, the fee is Rp10,000 per head.

A study conducted by Soedjana, *et al*. (1993) indicated that live animals transported from Nusa Tenggara Timur to Jakarta made 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 seven to eight animals. They have to stay in the quarantine station for about seven days. Second, the animals are then 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. They are transported 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 labor 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 of Soedjana (1993) reported that transport costs from Kupang (Nusa Tenggara Timur ) to Jakarta varies from Rp76,000 to Rp78,000 for cattle and Rp91,000 per head for buffalo, depending on the distance from the village of origin of the animals. The cost of transporting animals from various locations by different types of trucks is presented in Table 5.3.

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

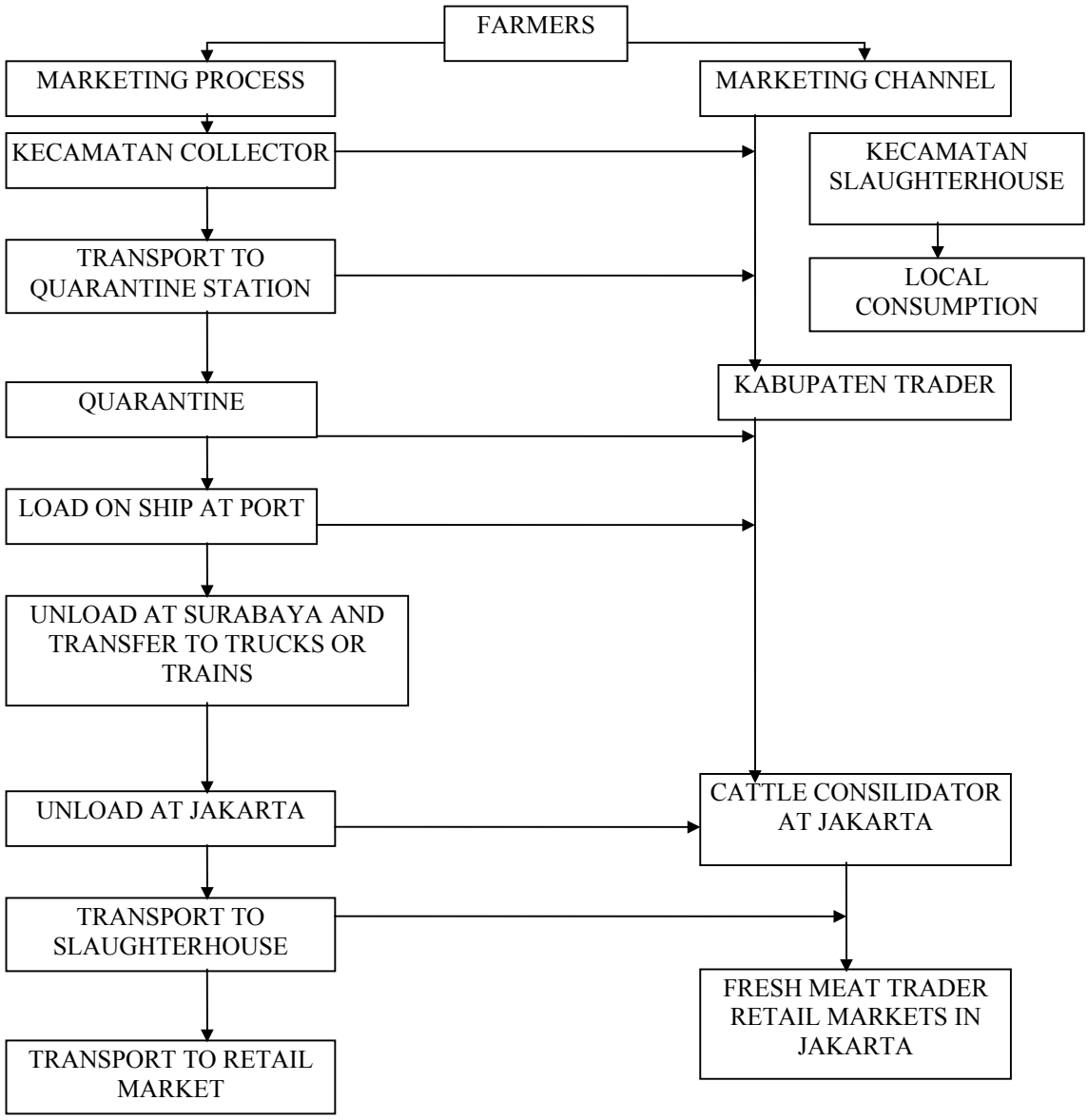
| Distance | Type of Truck | | |
|---|---|---|---|
| | Fuso (13-15 heads) | Colt Diesel (7-8 heads) | Tronton (11-12 heads) |
| | (Rp per head) | (Rp per head) | (Rp per head) |
| Sukabumi to Bogor (40 km) | 125,000 | 75,000 | |
| Sukabumi to Bandung (100 km) | 200,000 | 150,000 | |
| Sukabumi to Jakarta (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 transporting animals from, or to locations, where an outbreak of diseases has occurred. The role of the Livestock Examination Post located at the boundary between provinces is important since 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.

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




Source: Madamba, (1997)

## TRANSPORT OF PROCESSED PRODUCTS TO THE RETAILERS/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 slaughterhouses: Type B process meat for inter provincial distribution and Type C for inter-districts. 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 Rp1,850 per kg while from the Cakung to Jakarta it is Rp7,500 per carcass. Cakung is 40 km from Jakarta.

## OTHER ISSUES

Inter-island movement of live animals supplies beef cattle from potential 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.

**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 | 593 | 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/buffalo in Indonesia has increased imports of live cattle and meat (Table 5.5).

**Table 5.5 The number of imported cattle and meat imports, 1991 to 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 under the condition that they work with small farmers in their fattening program. 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 this could eventually reduce the local cattle/buffalo population substantially.

Companies from Australia, Denmark and the Philippines are the main ones involved in importing of 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 need 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 affects 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 since Indonesia consists of many islands. However, there are several constraints in the development of transportation facilities

Animal Feed

- Not all of the major islands in Indonesia have suitable harbour facilities to handle imports and to allow 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 cost will become expensive.
- The schedule of inter island feed transporting is uncertain, and sometimes the ships have to wait until they are fully loaded. This could reduce feed quality.
- There is no special ships for feedstuff. 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/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

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Animal protein consumption for Indonesian people comes mainly from beef/buffalo, sheep/goat, pork and poultry. In the 1990–1994 period, the commercial chicken population accounted for 64.2 per cent 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 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 to 85 per cent of the total production cost. Since poultry feed is composed of several raw materials, the cost and supply of raw material either produced locally or imported affects the feed industry.

This chapter provides information on the feed milling industry, including its structure, government support, and its raw material supply. As well, limitation of the industry and its future prospect will be discussed. With data being limited and difficult to collect, the information presented is the best available from either 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. Prior to then, feed production had been increasing at a rate of more than 10 per cent 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**

| 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 | 3,561,928 | 4,491,259 | 5,051,670 | 9,500,000 | 100.00 |

The data in Table 6.1 relates to the period 1995 to 1997. In 1988, Indonesia produced 1,401,176 tonnes of feed; in 1989 production was 1,511,203 tonnes and in 1990, it was 1,880,336 tonnes In the five year period 1990 to 1995, production of feed increased almost 100 per cent.

In the two years up until 1998, several new feed mill plants were established and this increased the capacity of the feed industry. Table 6.1 indicates that Indonesia has the capacity to produce 9.5 million tonnes per year of feed in 1997. This production is distributed to 25 feed mill companies. These companies operate more than 25 mills because many have three to six plants located in several places in Indonesia. The production of the feed industry utilises around 50 per cent 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. One other possible reason for the excess capacity is the tendency of companies to expand their feed mills to go for bigger capacity and possibly more efficient feed mills. 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 the companies in this category
- medium size feed mills with a production of more than 100,000 tonnes per year. This group is made up of eight companies, including Anwar Sierad, Cargills and Cintre.
- the small feed mills with a production of less than 100,000 tonnes per year.

All large feed mills are integrated with the poultry industry – each operates a grand parent stock farm, a parent stock farm, a commercial poultry operation, and a poultry processing plant. Trading companies are also a 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 (these have a capacity of 5000 to 15,000 tonnes) are able to carry oilseed meal from India, China or Argentine 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 Panama 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 license 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 per cent 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 nine per cent 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 species, 1997**

| Species | 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 due to the number of consumers of poultry products and the 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 were established in Serang (to the west of Jakarta) because a new port for handling corn was 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 the feed mill operation. The prices of raw materials are affected by season. However, there is very little use 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 this the wet season) 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, as 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 per cent of feed raw materials is imported, namely soybean meal, groundnut meal, rape seed 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 up until mid 1998, the Indonesian feed industry grew by around 12 per cent 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 affect also 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 by both local (PMDN) and 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 per cent at the initiation of the project, rising to 51 per cent after 15 years. Foreign investment located in a border zone (such as in Batam Island) and exporting 100 per cent of its

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

- labour intensive with at least 50 workers

- at least 65 per cent 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 the products from the feedmill. They can sell the output locally if they follow the quality and safety regulation. 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, 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/agent must have a trading license from the Minister of Industries and Trade

- feed mills remain responsible for feed quality and distributors or agents are prohibited to replace the original packing of feed

- animal feed can not be sold in the same area as chicken or eggs

- distributors/agents must comply with, and commit themselves to, the regulation 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 Organisation (BULOG) at one time did procure feed ingredients. However, in 1989, BULOG waived its monopoly right in the procurement of corn, fish meal 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 and for some feeds abolished. Import duties of feed ingredients were reduced to a range of zero to five per cent. 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 is 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 for machinery. There is no preferential treatment given to this industry. Investors can apply to the Coordinating Board for Investment (BKPM) with the 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 farm and the breeding farm. Although incentives are provided to build feed mills in certain areas, such as those given to foreign investment, very few feed mills have been built recently in the eastern parts of Indonesia. All new projects of feed mills 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 for improving the business climate may accelerate the growth of the feed industry. Since most of the industry is directed 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 is if poultry farms numbers decreased and local production of poultry were to be replaced by imports of poultry product. When the cost of production of poultry meat in the USA or Brazil is much less than that 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 consumer preference for hot carcasses of chicken, the effect of GATT on Indonesia is likely to be minor.

## INGREDIENTS

Since almost 90 per cent of feed produced by the feed mill industry is for poultry, the typical feed ingredient used will be similar to that 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 per cent of the total ration. Although the Directorate General for Livestock Services gave a typical formula of poultry feed, it has never been followed by feed mills due to the rapid development of nutrition and feed availability.

Unconventional feedstuffs are sometimes used by feed mills. 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 per cent is for human food, 29.5 per cent is for feed, 5 per cent is used as seed, 3.5 per cent is export and 0.5 per cent 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, the availability of other grains such as sorghum is very limited and available only in certain parts of Java during the dry season. With regard to corn production – presented in Table 6.4 – before 1990, Indonesia was self sufficient. However, as already noted, in the last 10 years the demand for corn for feeding poultry increased significantly as the poultry industry grew. This resulted in the importing of corn 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 is estimated that 4.1 million tonnes of corn is needed for the feed industry. In the beginning of 1990, corn was imported from China and Thailand. However, in recent years corn imports have been predominantly from the USA because of insufficient supply from China. The rate of increase up to 1994 was more than 12 per cent and at that time the trend in imports was expected to continue into the future. Before 1988, the National Logistic Organisation (BULOG) was the only agency authorised 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 to 1997**

| Year | Corn | | | | Rice bran | |
|---|---|---|---|---|---|---|
| | Production | Growth | Import | Growth | Production | Growth |
| | (Kt) | ( % ) | (Kt) | ( % ) | (Kt) | ( % ) |
| 1990 | 6,734.0 | – | 9.0 | – | 3,162.5 | – |
| 1991 | 6,256.0 | –7.1 | 323.3 | 3472 | 3,128.2 | –1.09 |
| 1992 | 7,995.5 | 27.8 | 55.9 | –83 | 3,376.8 | 7.9 |
| 1993 | 6,459.7 | –19.2 | 494.5 | 785 | 3,372.7 | –0.1 |
| 1994 | 6,868.9 | 6.3 | 1,118.3 | 126 | 3,264.9 | –3.2 |
| 1995 | 8,223.0 | 19.7 | 969.1 | –13.4 | – | – |
| 1996 | 7,953.6 | –3.3 | 616.9 | –36.4 | – | – |
| 1997 | 9,261.0 | 16.4 | 478.0 | –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 criteria. Although the moisture content of corn has been limited to a maximum of 16 to 17 per cent, 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 may be very necessary as much of the corn is harvested in the rainy season. Poor handling methods of 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 it also has to try to reduce corn imports. There are several options to increase corn production. The first two are to increase the corn area or to switch to hybrid corn. Increasing the area planted is perhaps more difficult due to competition with rice production. Alternatively, planting hybrid corn is more realistic but the adoption rate has been slow. In the last two to three years, the government launched a hybrid corn program with a target of 500,000 hectares of corn. The program covers Java, Lampung, South Sulawesi and North Sumatra. Currently, there are three hybrid corn producers in Indonesia – the Charoen Phokphand group, Cargill and Pioneer.

**Table 6.5 Imports of soybean meal and soybean, 1990 to 1997**

| Year | Soybean Meal | | Soybean | |
|---|---|---|---|---|
| | (Kt) | (% change) | (Kt) | (% change) |
| 1990 – 1991 | 5.2 | – | 526.3 | – |
| 1991 – 1992 | 193.3 | 3581 | 631.0 | 19.9 |
| 1992 – 1993 | 170.6 | –11.7 | 687.6 | 8.9 |
| 1993 – 1994 | 361.1 | 111.6 | 700.2 | 1.8 |
| 1994 – 1995 | 498.6 | 38.1 | 628.2 | –10.3 |
| 1995 – 1996 | 894.0 | 79.3 | – | – |
| 1996 – 1997 | 1,085.0 | 21.4 | – | – |

The second major ingredient for poultry feed is soybean meal. This material is all imported, coming from India, Argentine, Brazil, China and the USA. Although Indonesia grows more than 1.5 million tonnes of soybean per year, this production is not sufficient to meet the demand for processed products such as tempeh, tofu and soya sauce. In 1990, Indonesia established a soy bean 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 one million tonnes of soybean meal being imported in 1996–97. Between 1990 and 1994, imports increased at a rate of 9.4 per cent per year, almost a similar rate of increase as recorded for the poultry industry. A dramatic increase of more than 100 per cent happened from 1994 to 1997. The main supplier was India, followed by South America. The USA supplied 56,000 tonnes in 1996–1997 but none in 1997–1998. In contrast with whole soybeans, imports of US soybean meal are limited due to its higher price and the fact it cannot be shipped in small quantities. Only large feed mills can import soybean meal from USA using Panama 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 per cent 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 formula, although other alternative oilseed meal sources such as groundnut meal from India are available. Rape seed meal imported from India or China is also used in small quantities – the maximum is three per cent – due to possible toxicity and low digestibility.

The quality of soybean meal coming to Indonesia also varies not only in its protein content but also in other quality parameters such as KOH solubility and urease activity which indicates 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 also a major ingredient of poultry rations. The use of rice bran in broiler feed may account for up to 10 per cent of the ingredients while for layer feed this percentage can be up to 30 per cent. 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. Rice bran, however, cannot be stored for long periods due to 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 contamination of rice hulls. Observation in the field indicated that the hull inclusion may vary from close to zero to up to 50 per cent in rice bran. Since rice hull has no nutritive value as a poultry feed, feed mills need to check the amount of hull before accepting it for poultry feed. Other contaminants that have also been detected in the field includes cassava waste, soil, limestone and sawdust. The price of rice bran fluctuates more than any other local ingredient, and it can vary by more than 100 per cent depending on the season.

Indonesia also produces wheat pollard/bran as by product of wheat milling. Estimates are that 30 per cent 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 used in broiler rations, the addition of oil is sometimes needed. The type of oil available in Indonesia is crude palm oil and fish oil, the later 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, the USA or China. The local phosphate source is limited, with bone meal sometimes 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 ratio is influenced by price, availability and services provided by the supplier. Most feed mills use computer programs 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 ingredient 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 size feed mills, 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, as well as a margin for the trader.

On average about 82 to 85 per cent 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 both for layers and broilers through the years is shown in Table 6.6. As this table shows, prices rose steadily over the last few years due to the increase in price of local ingredient and the depreciation of the rupiah 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 FEED MILLING INDUSTRY

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

Based on income and population, Capricorn Indonesia Consult, Inc. (1996) predicted that chicken meat and egg consumption will increase steadily over the next few years (Table 6.7). Based on this prediction, it is possible to make forecasts of feed requirement. This is because 85 to 90 per cent of the feed is produced for broiler and commercial egg production. With almost equal production of feed for broilers and layers, feed requirements will increase at a rate of 8.3 per cent per year. The prospects of 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 investor 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 egg 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 broiler 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 utilise feed from their own farms.

The economic crisis in Indonesia has resulted in a severe set back 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, rape seed meal, synthetic amino acids (lysine, methionine), vitamins, minerals and drugs. However, the final price of feed is not three times higher and did not follow the US dollar exchange rate due to relatively low prices of corn and rice bran. The increase in feed price forced farmers to increase the price 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 population of poultry, both broilers and layers, has drastically fallen. Many have claimed that the total broiler population decreased from 15 million birds per week to only five million birds while the layer population decreased to less than 40 per cent 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 the 1998 production was at most only 40 per cent of production in 1997 (5,000,000 tonnes). Several feed mills have closed down while the surviving feed mills have reduced their production. As well, several feed mills in West Jakarta that have recently been built, have not yet operated. Also, new contracts to build feed mills have been cancelled.

It is not possible to predict when the situation will recover, since poultry farms are operating at 40 per cent capacity, and broiler and egg supplies have declined due to the lower purchasing power of the average household. Production from feed mills will not recover in 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 per cent per year in the first part of 1990. Production is dominated by commercial chicken feed for broilers and layers. This accounted for 85 per cent of the total feed production. The industry remains dominated by large and medium size feed mills. Large mills have a capacity of more than one million tonnes per year while medium mills have a capacity of more than 200 000 tones per year.

- About 30 per cent of the raw material for poultry feed is 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 demand 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 material.

- 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 prospect of the feed milling industry is uncertain and new plants have recently been established, the economic crisis has resulted in a dramatic draw back of the industry. If production drops to between 30 and 40 per cent of the pre crisis level, the future of the feed milling industry is becoming questionable.

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# 7. PROCESSING AND MARKETING OF LIVESTOCK PRODUCTS IN INDONESIA

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The livestock sector is an important segment within the economy of Indonesia, providing almost all meat and eggs and part of the milk 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 material for industry, and manure fertiliser for agriculture. In addition, the livestock industry has the potential to generate employment, increase rural income and result in the productive use of land.

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

This chapter provides information on the processing and the marketing of livestock products in Indonesia. The information on the processing sector includes 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. It needs to be noted that if the slaughterhouse was developed under the investment program based on Ordinance Number 1, 1967 of the foreign Investment Program or Ordinance Number 6, 1968 of the local Investment program, 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 number 33, 1981 and the Decree of President of the Republic of Indonesia Number 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 sourcing 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 over 900 slaughterhouses (Table 7.1). The slaughterhouses are 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 heads slaughtered per day
- type B for 50-100 heads slaughtered per day
- and C or D for 5-50 heads slaughtered per day.

**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

Based on the facilities available in them, there are three types of slaughterhouses: public slaughterhouses; modern slaughterhouse 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.

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 program is needed to rebuild them based on current requirements. For this to happen, foreign and private investors are needed to stimulate the activities of meat business. Almost 87 per cent of meat production in 1997 (876 kt of this is poultry), came from traditionally managed private slaughterhouses. Poultry slaughterhouse only provided a small portion of around 12 per cent. Furthermore, poultry slaughterhouses need to improve 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 of 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 slaughterings of animals in Indonesia from 1990 to 1995.

**Table 7.2 The number of recorded slaughterings of animal 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 waste disposal, was another reason for their construction. Under normal conditions, a slaughterhouse in Jakarta would handle 500 to 750 head of cattle and buffalo per day. During the holy days or Idul Fitri, as many as 2,000 to 2,500 cattle and buffalo are slaughtered each day. The slaughterhouse charge varies between Rp 15,000 to Rp 25,000 per head, including the overnight chilling of carcasses and refrigerated transport of carcasses to the markets. After resting animals for one night in pens, slaughtering starts at 1.00 pm. After bleeding, the carcasses are hoisted and move 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 consumer 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 process must be done quickly using very sharp knife by cutting the three gutters – the respiratory tract 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 has become a prime supplier of McDonald's for all of Indonesia. McDonald's International has given 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 have 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. Again, 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 hanging meat 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 | Transportation fees |
|---|---|---|
| | (Rp/head) | (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 is associated with the DGLS, but they are under the administrative control and are paid by local authorities. Consequently, the livestock specialists at slaughterhouse are not very keen to implement and to enforce standards, especially where expenditure by local authorities is necessary to resolve problems.

**Meat Processing**

Slaughtering of domesticated animals and handling procedure for meat and offals are regulated under the Decree of Minister for Agriculture number 413/Kpts/TN.310/1992. Before slaughtering the animals, the inspecting officer has to carry out antemortem inspection of standing and moving position of the animals from all directions, mouth ephitelium, eyes and nose, skin, sub maxillaries, lymph node, paratidea, pre scapularis and inguinal, sign of hormonal treatment and body temperature. At the end of the inspection the animals is classified into one of the following:

- 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, and
- the animal is not allowed to be slaughtered at all.

Postmortem inspection is carried out by the inspector as soon after completion of slaughtering as possible. This takes place in a special room or other approved place with sufficient lighting. The postmortem inspection involves a simple procedure such as a smell test and a visual test of meat colour. The purpose of postmortem inspection is to guarantee the hygiene and suitability of the product for human consumption. At the end of the inspection, the meat is classified into meat able to be distributed for human consumption; meat suitable for human consumption provided certain requirements are met before distribution; meat that may be distributed for human consumption provided certain requirements being met during distribution; or meat that is not permitted to be distributed and not recommended for human consumption.

Meat should conform to approved handling method. 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 can not be treated with other materials or chemicals that can change its natural color.

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 is also of an 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 prepared in small, semi-mechanised 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 prime grade beef required especially by hotel 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 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 to 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, restaurant, and supermarkets (Figure 7.1).

Increasing beef demand 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:

- 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
- bargaining power of buyers allows them to select any beef products to improve their competitive position
- threats of substitution with imported beef, chicken, lamb, goat and pork
- 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 affects the prices of final products.

**Figure 7.1 Market structure for beef cattle**

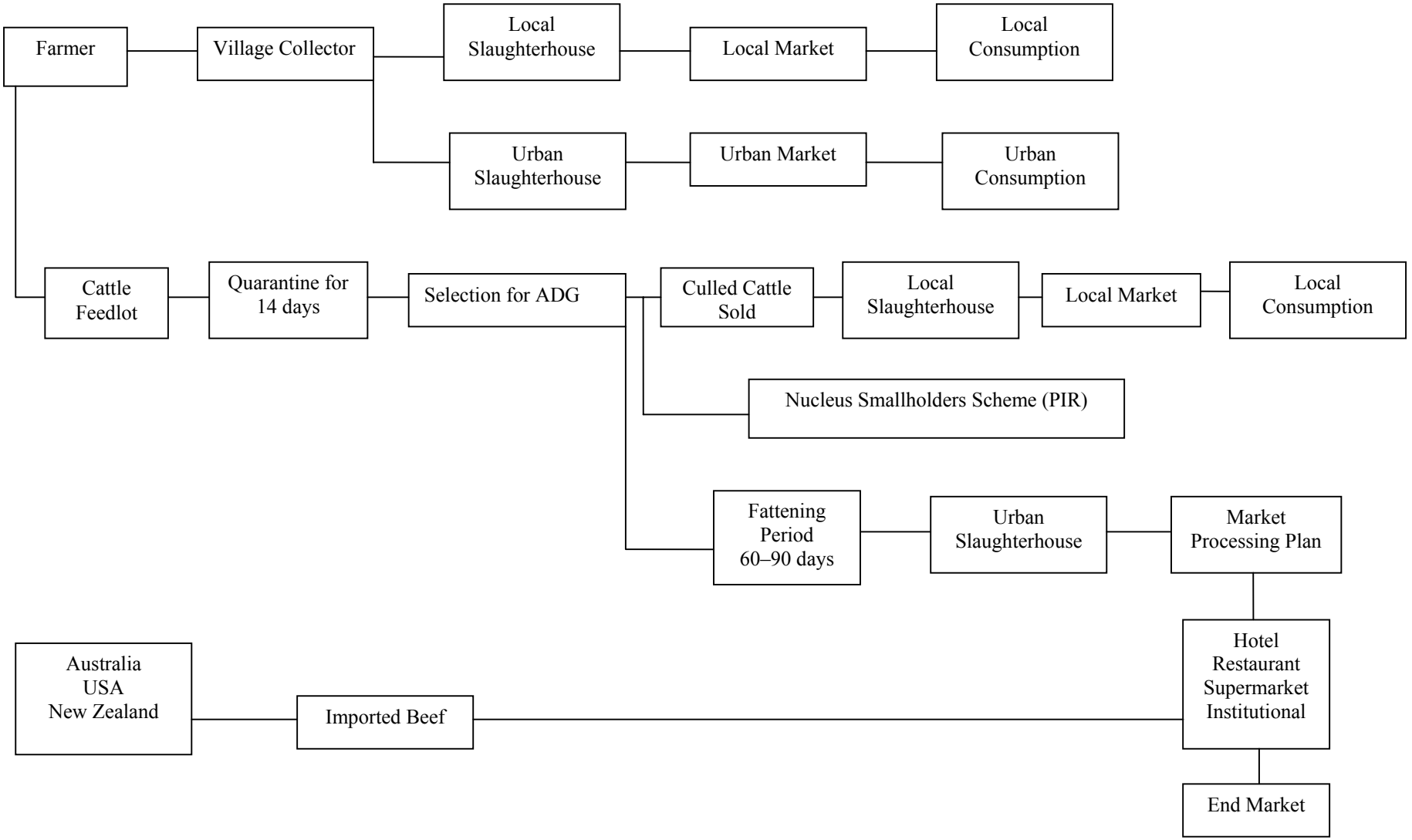
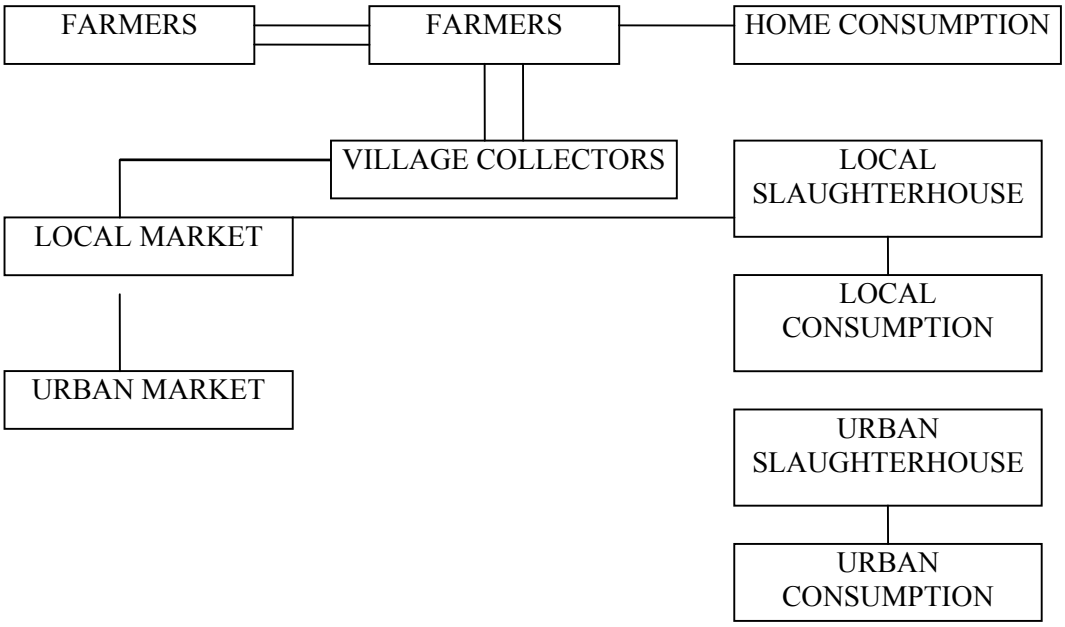


**Figure 7.2: Market structure for small ruminants**




Source: (Knipscheer, *et al.,* 1987)

A simplified picture of the marketing for small ruminants in West Java is illustrated in Figure 7.2. 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 to sell 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 per cent 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, while in North Sumatra was not found to be case.

In Java, a relatively stable relationship seems to exist between trader and farmer, which is characterized as the traditional market system with a cash/credit payment arrangement. A similar system was found in Aceh, but in North Sumatra no credit system seems to exist 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.

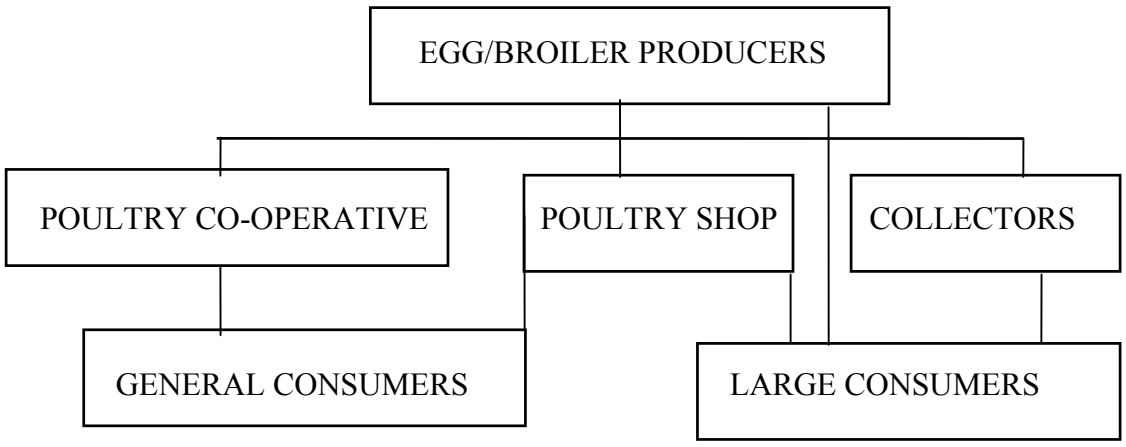
The broker operates in the marketplace, and three types of brokers are common: the commission broker, the floor-price broker, and the price-fixing broker (Soedjana *et al*., 1992). The commission broker sells animals for a flat fee, the floor-price broker arranges a floor price with the farmer and then tries to sell the animals above that; and the price-fixing broker pays a percentage of an agreed upon price to the farmer and then tries to sell the animals. When this occurs 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 as 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 particular unsatisfactory where there is evidence of 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 importance of the poultry shop as an input supplier is particularly true 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, since many of the large feed mill industry 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 farmer's problems. Through this organization, farmers may substantially reduce their dependency on other agents for inputs. However, poultry co-operatives that were pioneered by the government can not 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 in equal and parallel development with the development of the large scale poultry company through partnerships. Poultry co-operatives should not only focus on the raising animals, but should also become involved in post-production marketing.

The global market should be an international market, free from government intervention. This means that every country should be open to imports and the local products should be able to exports. Materials and services will 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. In the case of poultry products, these are world products and not products of a limited number of 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 globalisation.

The best partnership pattern occurs by reorganising the national poultry industry, making use of comparative advantage and creating products of good quality. Therefore, the national poultry industry has to be a vertically integrated industry with streamlined operations. The objectives of national policy are to determine the minimum and the maximum sizes of each farm, consistent with availability of feed ingredients and local agricultural products.
The development element in the partnership operation includes technical aid that will increase the productivity of the small-holder farmers. Increase in productivity is indicated through in a good feed ratio. The smallholder's increased productivity will then be conducive for the formation of a partnership, because such a partnership will create efficiency. Smallholders in Indonesia have been the backbone of livestock production, specifically in the rearing business. Therefore, if there is a target to build an efficient livestock production system, smallholders need to be in partnership with large, modern companies.

The period 1972 to 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 Number 50/1980 limited the broiler and layer business: (b) Presidential Decree Number 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 product within fourteen days

- the smallholder is responsible for providing land and housing for 5,000 to 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.

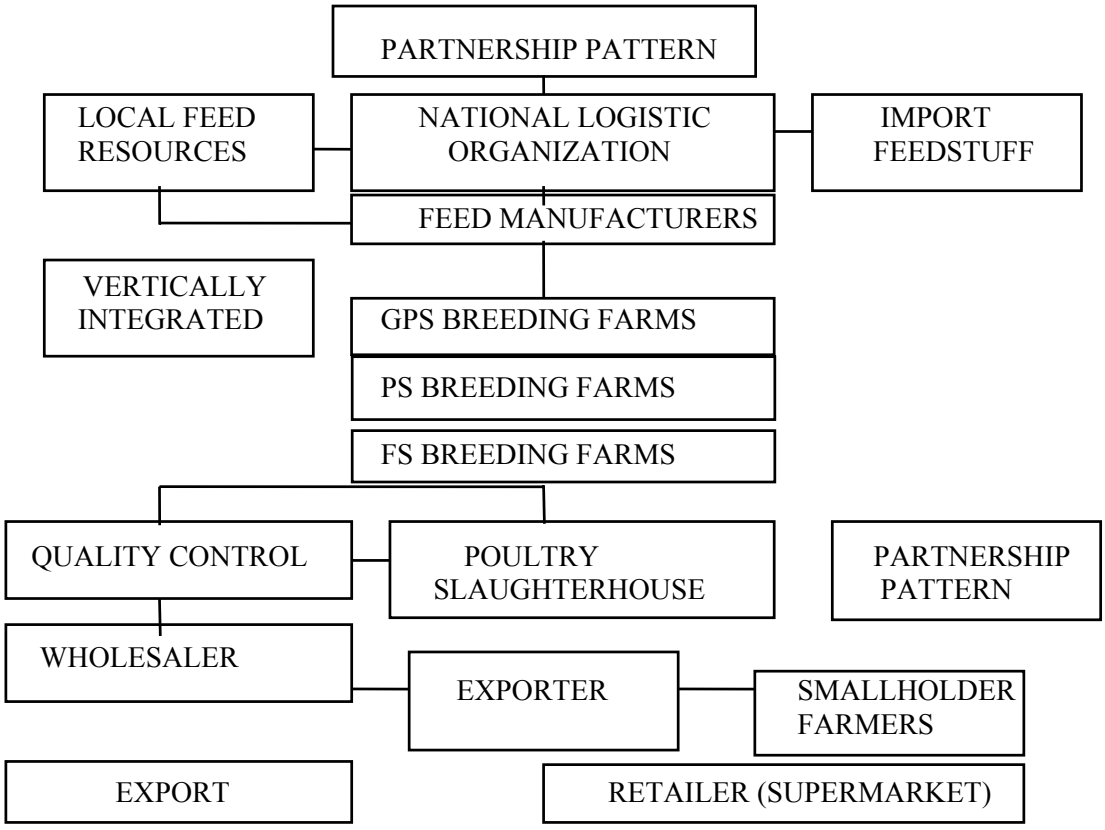
To guarantee that the smallholder bears the smallest business risk, a safety regulation is made in the agreement. Namely (a) an income guarantee of 5.8-6 per cent of the total costs, and (b) a fixed price based on the components of production costs and income guarantee. If the market price of production is higher than the fixed price, the farmer receives a bonus of 20 per cent 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 housing area of 500 $m^2$ 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 per cent 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 cycle 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.

**Figure 7.4: Alternative marketing channels of poultry business through a partnership pattern**




Source : Yusmichad *et al*. (1995)

## CONCLUDING COMMENTS

In order to produce hygienic and wholesome products for customers, the establishment of meat processing plant in Indonesia should be in line with The Decree of Minister of Agriculture Number 555/Kpts/TN.240/9/1986 on the Requirement for Abattoir and Abattoir Enterprise as well as the Decree of Minister for Agriculture Number 413/Kpts/TN.310/7/1992 on Slaughtering of Domesticated Animals and Handling Procedure for Meat and Offals.

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 policy is to up-grade 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 programs. 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 modernise the transport of slaughter animals (cattle, buffalo, sheep, goats, and pig) from the farmers/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 exists 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 which routinely would yield market price data and production projections that should be based on the periodic verification of livestock numbers and production. Market prices should be broadcast and published daily. With respect to national poultry industry, it has to become vertically integrated with up to date facilities.

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# 8. CLASSIFICATION OF INDONESIAN DAIRY CO-OPERATIVES

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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. Co-operatives that the government views as successful under the classification system may be encouraged to expand or 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 as to how best the government should classify Indonesian co-operatives.

## CURRENT CLASSIFICATION SYSTEM

The current system of classification of Indonesian dairy co-operatives used by the Ministry of Co-operatives, the government ministry responsible for overseeing the operations of Indonesia's co-operatives, is based on the daily milk production of the co-operative, averaged over a three year period. Table 8.1 shows the classification levels currently in use.

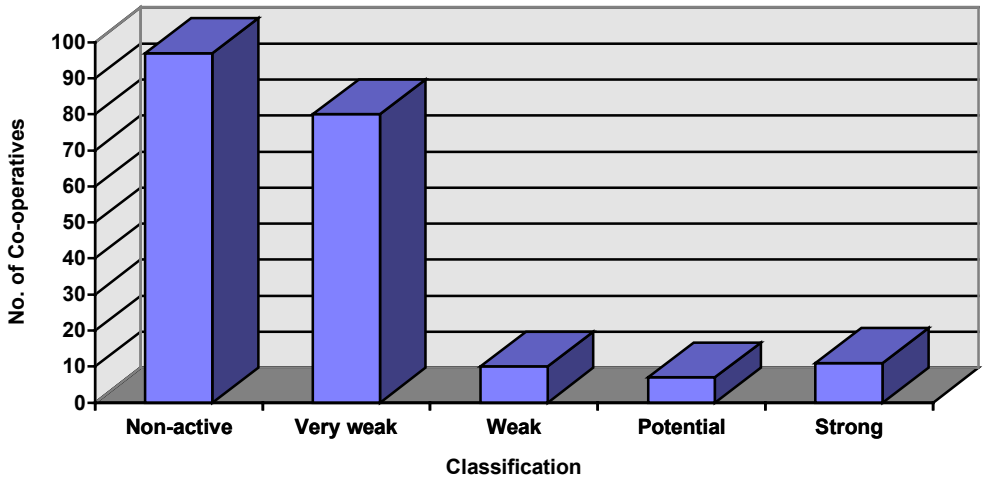
**Table 8.1 Classification criteria**

| Milk Production | Classification | Condition |
|---|---|---|
| (litres/day) | | |
| more than 20000 | A | Strong |
| 10000-20000 | B | Potential |
| 5000-10000 | C | Weak |
| less than 5000 | D | Very Weak |
| 0 | E | 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 per cent are either classed 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 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 operations, 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 per cent 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.

## PRODUCTION PER FARM AS A CLASSIFICATION CRITERIA

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

**Table 8.2 Farm productivity based criteria**

| Criteria | Classification |
|---|---|
| (l./farm/day) | |
| under 0-5 | A |
| 5-10 | B |
| 10-20 | C |
| over 20 | D |

Figure 8.2 shows the number of 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 by aggregate production from the co-operative. Figure 8.2 does not show, however, whether the productivity and output based criteria give similar rankings to the co-operatives.

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

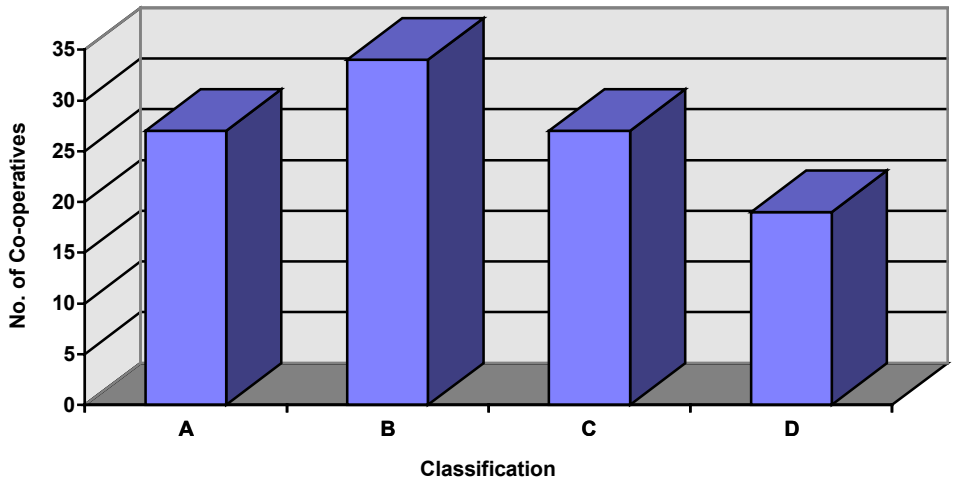
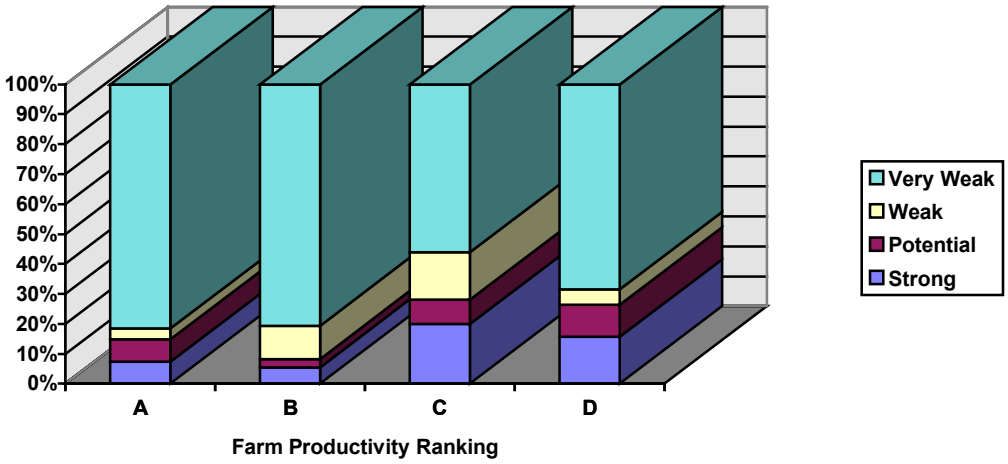



Figure 8.3 shows the proportion of co-operatives in each farm productivity criteria ranked by their original (output based) rankings.

**Figure 8.3 Comparison of farm productivity and 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 litres per day - do not necessarily have a high level of output.

- Low output co-operatives - these are the co-operatives classified as very weak on the basis of total production - could have members able to produce a very high output per farm.

- Co-operatives where the average farmer is able to produce 10 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 output as compared to those co-operatives where the average farmer produces less than 10 litres 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 per farm output may be achieved simply by having a large number of animals per farm.

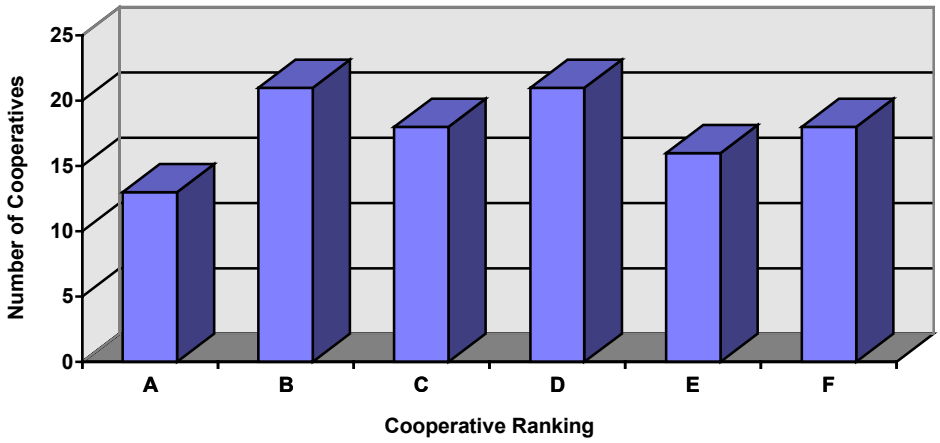
## PRODUCTION PER ANIMAL AS A CLASSIFICATION CRITERIA

To overcome the bias just referred to, 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 this criteria are shown in Table 8.3 and Figure 8.4.

**Table 8.3 Criteria for ranking dairy co-operatives based on production per cow per day**

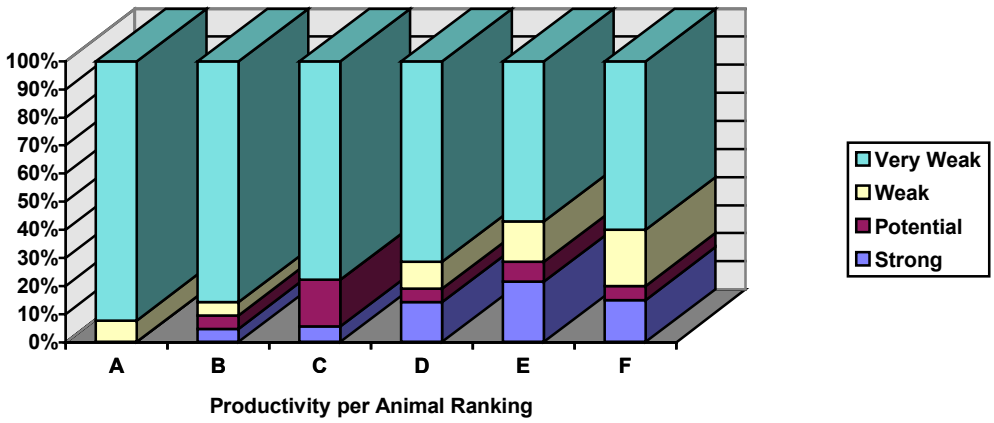
| Output | Ranking |
|---|---|
| (l./cow /day) | |
| 0-1 | A |
| 1-2 | B |
| 2-3 | C |
| 3-4 | D |
| 4-5 | E |
| >5 | F |

**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 criteria based on their original (output based) rankings.

**Figure 8.5 Comparison of animal productivity and output based rankings**




It is apparent from Figure 8.5 that

- although not as evenly distributed as the farm productivity rankings, 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 five litres per day were ranked as very weak in the output based criteria.

## 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's rank correlation co-efficients calculated using the three ranking systems are presented in Table 8.4.

**Table 8.4 Calculated Spearman Rank correlation coefficients, 1994 data**

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

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

- The weak positive relationship between the output based 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 production 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, Riethmuller, Smith and Hutabarat, 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 approaches to ranking co-operatives detailed above has advantages and disadvantages. The technique being used in the late 1990s focuses on co-operative size as a measure of strength by ranking co-operatives on average daily *total* 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 second technique suggested focuses on productivity per farm. Whilst being a useful tool for measuring the ability of the farm unit to produce milk, 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 final criteria 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, in that no account is taken 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 techniques outlined above may be to use all three approaches in tandem, 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 the co-operatives output would be a valuable adjunct in decision making. If however, a program 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. Protection of a sector or industry is given 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 different 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

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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 per cent of Indonesian fresh milk production comes from smallholder dairy farms. Some of the problems faced by smallholder dairy farmers are lack of capital, low technology and insufficient human resources. On the basis of its performance to date, the dairy industry will be unable 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 (or KUDs), and in particular to analyse the dividends distributed to their members. It also attempts to analyse how the KUD determines the price of fresh milk received by the farmers.

Specifically, it will describe the cost structure of the KUD in one budget year and examine whether 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. Firstly, KUDs operate their business with the broad objective of minimising costs or maximising benefits to the member farmers. Secondly, KUDs help their members to obtain cheaper priced inputs and at the same time to obtain a selling price for the farm's output that is as high as possible.

If KUDs applied the principle of 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 other groups 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 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 share holders would authorise the KUD officials to operate the business and the KUD profits would be distributed to the members. However, if KUDs operate as an intermediary between the dairy farmers and the processors, all decisions would need to be made by the members.

KUDs prioritise their services to members. Problems can arise with respect to the businesses operated by the co-operative and the services that the co-operative provides to its dairy farmer members. The farmers, as producers who rely on the assistance of KUDs, expect it to minimise its operating costs. This will 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 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 member’s 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. However, this estimation requires information on profits (or costs) and input prices. Such information was not available for a sufficiently large number of co-operatives for this approach to be used. Instead, the analysis will be done through assessment of the cost structure of the dairy cattle unit and its position among the other business units in the co-operatives.

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 was examined, most of the members of the co-operative were dairy farmers. Besides cost structure, dividend payments generated from dairy cattle business unit will be examined and compared with dividends from other business units. All of the analysis will be 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 which have dairy farming as their largest business unit. The KUDs in East Java were stratified by total milk produced in 1994 and then 13 KUDs (or 20 per cent 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 along with the quantity of milk produced by all KUDs in East Java. There were 44 KUDs in the population producing less than 5000 litres of milk per day. Nine of these were sampled. Milk production was greater than 5000 litres per day for 11 others in the population, 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 through interviewing the KUD officials and the managers of the dairy cattle unit in each KUD using structured questionnaires. Cost structures were analysed through making use of 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) | Total KUD | Total sample |
|---|---|---|---|
| A | over 20000 | 5 | 2 |
| B | 10000 – 20000 | 1 | 0 |
| C | 5000 – 10000 | 7 | 2 |
| D | less than 5000 | 41 | 2 |
| | a. 500 | | 2 |
| | b. 1500 | | 2 |
| | c. 2500 | | 2 |
| | d. 5000 | 11 | 3 |
| E | Non active | | 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, GKSI classifies all of the KUD into five groups based on total production per year, namely A (strong), B (potential), C (weak), D (very weak), and E (non active). The classification is based only on the ability of the KUD to produce milk without considering the performance of farmers individually. It is possible that some dairy farmers of group E (weak co-operatives) have better performance than those of group A (the strong co-operatives).

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

Table 9.2 shows the distribution of KUDs by the groups into which the GKSI has classified them. There are some interesting points, namely :

- 63 per cent of KUD's have a relatively low total production of fresh milk, and are classified as very weak (D). Although this group make up the majority 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 group A and B make up only about 10 per cent of the total number of co-operatives, but they produce 66 per cent of the total production. Almost all of the total fresh milk production of the GKSI in East Java depends on the five KUDs of group A.

- most (63 per cent) 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 the co-operative comprises a large farmer and cattle population. In fact group C co-operatives had cows that were the most productive. This is shown by the fact that they were responsible for 14 per cent of daily milk production from 9 per cent of cows.

- in general, to achieve a high level of production, the policy of the GKSI and KUD's has been to increase total dairy co-operatives, total dairy farmers, and distribute more cattle to the farmers.

**Table 9.2 KUD distribution by GKSI classification in East Java, 1994**

| | Unit | Group | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | Total |
| KUD | no | 5 | 1 | 7 | 41 | 11 | 65 |
| | % | 8 | 2 | 11 | 63 | 17 | 100 |
| Farm | '000 | 160 | 4 | 44 | 44 | 2 | 254 |
| | % | 63 | 2 | 18 | 17 | 1 | 100 |
| Dairy cattle | '000 | 59 | 2 | 8 | 19 | 0.4 | 88 |
| | % | 67 | 2 | 9 | 21 | 0.5 | 100 |
| Milk | 000 litre | 216 | 10 | 47 | 52 | 0 | 325 |
| production | % | 66 | 3 | 14 | 16 | 0 | 100 |

Source: GKSI, East Java Regional Coordinator
Notes : Group A = production over 20000 litres/day
Group B = production 10000 – 20000 litres/day
Group C = production 5000 – 10000 litres/day
Group D = production under 5000 litres/day
Group E = production 0 litre/day.

**Trends in KUDs 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 had moved to group A over the period covered by the table.

**Table 9.3 Milk production in sample KUDs by GKSI classification, East Java**

| Group | Average production | 1992 | 1993 | 1994 | Growth rate 1992–1994 |
|---|---|---|---|---|---|
| | (litres per year) | | | | (%) |
| A | 47143 | 4 | 4 | 5 | 12.5 |
| B | 18714 | 1 | 2 | 1 | 0.0 |
| C | 7364 | 5 | 4 | 7 | 20.0 |
| D | 1321 | 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 is shown in Table 9.4. The classification scheme used in Table 9.4 is not the same as that used by GKSI 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 litres of milk per year (these are group 1), and 1948 farmers producing 15000 litres or more per year (Group 6). The ownership ranges from one to two 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 | Total farmers | Lactating cows | Dry cows | Total milking cows | Heifers | Total |
|---|---|---|---|---|---|---|---|
| | (litres/year) | | | | | | |
| 1 | 500 | 179 | 0.1 | 0.3 | 0.4 | 0.5 | 0.9 |
| 2 | 1500 | 6225 | 1.2 | 0.2 | 1.3 | 0.3 | 1.6 |
| 3 | 2500 | 789 | 1.3 | 0.4 | 1.7 | 0.1 | 1.9 |
| 4 | 4000 | 599 | 1.5 | 0.3 | 1.8 | 0.4 | 2.3 |
| 5 | 10000 | 928 | 2.7 | 0.5 | 3.1 | 0.7 | 3.8 |
| 6 | 15000 | 1948 | 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 per cent per year over the three year period from 1992 to 1994. Most of the decline occurred in group A. Here the cattle numbers fell by 2.9 per cent 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 of cattle population is to increase on average by 2.5 per cent per year, with a range of from 1.9 to 8.4 per cent 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 per cent 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 per cent from 3.2 litres per head per day.

Some important conclusions of the discussion above are :

- 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 be viable. On the basis of the 1994 population of cattle, farmer numbers would need to fall by between 40 and 50 per cent for the target to be reached.

**Table 9.5 Trends of farmers, cattle, and fresh milk production of KUD in East Java, 1992–1994**

| Item | Unit | 1992 | 1993 | 1994 | Growth rate 1992-1994 |
|---|---|---|---|---|---|
| | | | | | (%) |
| Group A | | | | | |
| - Farmer | no. | 14894 | 14045 | 14045 | –2.9 |
| - Population | no. | 53069 | 53300 | 55036 | 1.9 |
| - Production | l. | 178771 | 191952 | 194992 | 4.5 |
| - Production/farmer | l. | 12.0 | 13.7 | 13.9 | 7.8 |
| - Production/population | l. | 3.4 | 3.6 | 3.5 | 2.6 |
| - Population/farmer | no. | 3.6 | 3.8 | 3.9 | 5.0 |
| Group B | | | | | |
| - Farmer | no. | 1948 | 1948 | 1948 | 0.0 |
| - Population | no. | 3928 | 3785 | 3785 | –1.8 |
| - Production | l. | 16232 | 19295 | 20616 | 13.5 |
| - Production/farmer | l. | 8.7 | 9.9 | 10.6 | 13.5 |
| - Production/population | l. | 4.1 | 5.1 | 5.4 | 15.9 |
| - Population/farmer | no. | 2.0 | 1.9 | 1.9 | –1.8 |
| Group C | | | | | |
| - Farmer | no. | 3416 | 3416 | 3416 | 0.0 |
| - Population | no. | 7520 | 7938 | 8785 | 8.4 |
| - Production | l. | 30919 | 38323 | 41214 | 16.6 |
| - Production/farmer | l. | 9.1 | 11.2 | 12.1 | 16.6 |
| - Production/population | l. | 4.1 | 4.8 | 4.7 | 7.1 |
| - Population/farmer | no. | 2.2 | 2.3 | 2.6 | 8.4 |
| Group D | | | | | |
| - Farmer | no. | 6759 | 6874 | 6870 | 0.8 |
| - Population | no. | 20416 | 20960 | 21504 | 2.7 |
| - Production | l. | 48039 | 58279 | 68075 | 20.9 |
| - Production/farmer | l. | 7.1 | 8.5 | 9.9 | 19.7 |
| - Production/population | l. | 2.4 | 2.8 | 3.2 | 17.3 |
| - Population/farmer | no | 3.0 | 3.0 | 3.1 | 1.8 |
| Total | | | | | |
| - Farmer | no. | 27017 | 26283 | 26279 | –1.4 |
| - Population | no. | 84933 | 85983 | 89110 | 2.5 |
| - Production | l. | 273961 | 307849 | 324897 | 9.3 |
| - Production/farmer | l. | 10.1 | 11.7 | 12.4 | 11.0 |
| - Production/population | l. | 3.2 | 3.6 | 3.6 | 6.5 |
| - Population/farmer | no. | 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 other businesses that the KUDs are involved in include milk processing, feed stuff processing and supply, fertiliser 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 business.

The farmers are independent milk producers because they have to decide anything related to their business 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 fresh milk produced by the farmers. Although the farmer is under no contractual obligation to do so, in practical terms each farmer has to sell their fresh milk to the KUD of which they are a member. 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 monosopnistic 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 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 that of the farmers or KUDs.

### Cost Structure

As mentioned previously, the 13 KUD were selected using stratified random sampling. Six strata were defined on the basis of daily production. These were 500 litres, 1500 litres, 2500 litres, 5000 litres, 10,000 litres and 15,000 litres.

- It can be seen from Table 9.6 and Table 9.7 that the cost to the KUD vary 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 quality difference of 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.

There are two main factors affecting the farm gate price of fresh milk.

- The first of these is the quality of the fresh milk, where quality is determined by density and fat content. The higher the fat content, the higher the price of fresh milk. However, fresh milk price based on this quality is difficult to implement. Fat content and water content are recorded every morning and afternoon in the collecting points. On the other hand, 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 also measure the fresh milk quality. The fresh milk quality measurement is for all 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 KUD. The KUDs then pass on this price to the farmers, less costs.

- The costs incurred by the KUDs for all of their businesses are financed 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 there are three groups making losses. These were the smallest (500litres per day), and the medium sized KUDs (2500 litres per day and 4000 litres per day). In each annual report of the KUD, almost all dairy cattle business units are profitable, but overall KUD's business generate losses. This is due to the costs expended by KUD to carry out all their activities. Obviously, the co-operatives did not produce these milk volumes exactly on any particular day. Rather, the production levels used to stratify the opulation were approximate and represent "average" daily production.

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

| Item | Daily production | | | | | |
|---|---|---|---|---|---|---|
| | (500 l.) | (1500 l.) | (2500 l.) | (4000 l.) | (10000 l.) | (15000 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 KUD**

| Item | Daily production | | | | | |
|---|---|---|---|---|---|---|
| | (500 l.) | (1500 l.) | (2500 l.) | (4000 l.) | (10000 l.) | (15000 l.) |
| Salaries and bonus | 12 | 21 | 22 | 18 | 18 | 15 |
| Organisation 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 profits 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 are Rp 220 million, it is not distributed just to the dairy farmers. The profit belongs to the KUD and the KUD officials may utilise 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 etc. The KUD generally uses more of the profits to operate the business of the KUD, not to improve the farming operations of the members. This is in accordance with business principles of the KUD. 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 dairy business unit were to be minimised, 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 operation.

**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 | 2261044 | 348112 | 132014 | 1559979 | 2040104 | 220940 |
| Electricity | 9382 | 7373 | 899 | 0 | 4272 | 5110 |
| Price | 111908 | 472 | 83 | 106909 | 107464 | 4444 |
| Soybean cake | 11137 | 958 | 1807 | 4455 | 7219 | 3918 |
| Credit | 7356 | 2827 | 2558 | 0 | 3385 | 1971 |
| TVRI tax | 3045 | 1535 | 300 | 0 | 1836 | 1209 |
| Sugar | 30718 | 2496 | 307 | 27819 | 30622 | 96 |
| TRI | 411 | 461 | 65 | 0 | 526 | –114 |
| KUT | 240 | 3 | 366 | 0 | 369 | –129 |
| Food | 41595 | 3159 | 191 | 38466 | 41817 | –221 |
| Fertilisers | 126080 | 6498 | 647 | 121241 | 128386 | –2306 |
| Cipro | 267630 | 5668 | 44 | 275221 | 280933 | –13303 |
| General | 15612 | 99207 | 88313 | 7852 | 195372 | –179760 |
| Total | 2886159 | 474768 | 227593 | 2141943 | 2844305 | 41855 |

## CONCLUSION AND POLICY IMPLICATIONS

In East Java during the three year period 1992 to 1994, there were 80 KUDs, of which 65 per cent are either very weak or inactive. There was little or no increase in total members, and in the cattle population. Most dairy farmers have only one lactating cow with a production rate of 3000 litres per year or less. This is the main reason why milk production levels in East Java have only grown slowly.

At the KUD level, some findings are as follows :

- Total costs for fresh milk production vary among KUD and there is no clear relationship between scale and expenses. It could be concluded that the KUD business may not be efficient and has a number of different structures in different KUD.

- 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. KUDs apparently prefer to increase total members and total cattle to expanding 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 monosopnistic fashion.
- The profits from the dairy cattle business unit are not distributed to the farmers. KUDs have many activities involving a range of inputs and a variety of different outputs. Profit

distribution is the authority of KUD and its management is not obligated 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 of 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 subsidising less profitable business units. An alternative to having the co-operative specialising only in dairying would be to operate each business unit separately to other business units. This would require tight financial control at the co-operative level to ensure costs are assigned to the enterprise incurring 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 programs to increase the production of milk the GKSI 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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# 9. A STUDY OF COST STRUCTURES OF DAIRY CO-OPERATIVES AND FARMER INCOMES IN EAST JAVA

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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 per cent of Indonesian fresh milk production comes from smallholder dairy farms. Some of the problems faced by smallholder dairy farmers are lack of capital, low technology and insufficient human resources. On the basis of its performance to date, the dairy industry will be unable 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 (or KUDs), and in particular to analyse the dividends distributed to their members. It also attempts to analyse how the KUD determines the price of fresh milk received by the farmers.

Specifically, it will describe the cost structure of the KUD in one budget year and examine whether 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. Firstly, KUDs operate their business with the broad objective of minimising costs or maximising benefits to the member farmers. Secondly, KUDs help their members to obtain cheaper priced inputs and at the same time to obtain a selling price for the farm's output that is as high as possible.

If KUDs applied the principle of 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 other groups 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 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 share holders would authorise the KUD officials to operate the business and the KUD profits would be distributed to the members. However, if KUDs operate as an intermediary between the dairy farmers and the processors, all decisions would need to be made by the members.

KUDs prioritise their services to members. Problems can arise with respect to the businesses operated by the co-operative and the services that the co-operative provides to its dairy farmer members. The farmers, as producers who rely on the assistance of KUDs, expect it to minimise its operating costs. This will 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 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 member’s 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. However, this estimation requires information on profits (or costs) and input prices. Such information was not available for a sufficiently large number of co-operatives for this approach to be used. Instead, the analysis will be done through assessment of the cost structure of the dairy cattle unit and its position among the other business units in the co-operatives.

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 was examined, most of the members of the co-operative were dairy farmers. Besides cost structure, dividend payments generated from dairy cattle business unit will be examined and compared with dividends from other business units. All of the analysis will be 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 which have dairy farming as their largest business unit. The KUDs in East Java were stratified by total milk produced in 1994 and then 13 KUDs (or 20 per cent 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 along with the quantity of milk produced by all KUDs in East Java. There were 44 KUDs in the population producing less than 5000 litres of milk per day. Nine of these were sampled. Milk production was greater than 5000 litres per day for 11 others in the population, 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 through interviewing the KUD officials and the managers of the dairy cattle unit in each KUD using structured questionnaires. Cost structures were analysed through making use of 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) | Total KUD | Total sample |
|---|---|---|---|
| A | over 20000 | 5 | 2 |
| B | 10000 – 20000 | 1 | 0 |
| C | 5000 – 10000 | 7 | 2 |
| D | less than 5000 | 41 | 2 |
| | a. 500 | | 2 |
| | b. 1500 | | 2 |
| | c. 2500 | | 2 |
| | d. 5000 | 11 | 3 |
| E | Non active | | 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, GKSI classifies all of the KUD into five groups based on total production per year, namely A (strong), B (potential), C (weak), D (very weak), and E (non active). The classification is based only on the ability of the KUD to produce milk without considering the performance of farmers individually. It is possible that some dairy farmers of group E (weak co-operatives) have better performance than those of group A (the strong co-operatives).

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

Table 9.2 shows the distribution of KUDs by the groups into which the GKSI has classified them. There are some interesting points, namely :

- 63 per cent of KUD's have a relatively low total production of fresh milk, and are classified as very weak (D). Although this group make up the majority 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 group A and B make up only about 10 per cent of the total number of co-operatives, but they produce 66 per cent of the total production. Almost all of the total fresh milk production of the GKSI in East Java depends on the five KUDs of group A.

- most (63 per cent) 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 the co-operative comprises a large farmer and cattle population. In fact group C co-operatives had cows that were the most productive. This is shown by the fact that they were responsible for 14 per cent of daily milk production from 9 per cent of cows.

- in general, to achieve a high level of production, the policy of the GKSI and KUD's has been to increase total dairy co-operatives, total dairy farmers, and distribute more cattle to the farmers.

**Table 9.2 KUD distribution by GKSI classification in East Java, 1994**

| | Unit | Group | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | Total |
| KUD | no | 5 | 1 | 7 | 41 | 11 | 65 |
| | % | 8 | 2 | 11 | 63 | 17 | 100 |
| Farm | '000 | 160 | 4 | 44 | 44 | 2 | 254 |
| | % | 63 | 2 | 18 | 17 | 1 | 100 |
| Dairy cattle | '000 | 59 | 2 | 8 | 19 | 0.4 | 88 |
| | % | 67 | 2 | 9 | 21 | 0.5 | 100 |
| Milk | 000 litre | 216 | 10 | 47 | 52 | 0 | 325 |
| production | % | 66 | 3 | 14 | 16 | 0 | 100 |

Source: GKSI, East Java Regional Coordinator
Notes : Group A = production over 20000 litres/day
Group B = production 10000 – 20000 litres/day
Group C = production 5000 – 10000 litres/day
Group D = production under 5000 litres/day
Group E = production 0 litre/day.

**Trends in KUDs 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 had moved to group A over the period covered by the table.

**Table 9.3 Milk production in sample KUDs by GKSI classification, East Java**

| Group | Average production | 1992 | 1993 | 1994 | Growth rate 1992–1994 |
|---|---|---|---|---|---|
| | (litres per year) | | | | (%) |
| A | 47143 | 4 | 4 | 5 | 12.5 |
| B | 18714 | 1 | 2 | 1 | 0.0 |
| C | 7364 | 5 | 4 | 7 | 20.0 |
| D | 1321 | 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 is shown in Table 9.4. The classification scheme used in Table 9.4 is not the same as that used by GKSI 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 litres of milk per year (these are group 1), and 1948 farmers producing 15000 litres or more per year (Group 6). The ownership ranges from one to two 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 | Total farmers | Lactating cows | Dry cows | Total milking cows | Heifers | Total |
|---|---|---|---|---|---|---|---|
| | (litres/year) | | | | | | |
| 1 | 500 | 179 | 0.1 | 0.3 | 0.4 | 0.5 | 0.9 |
| 2 | 1500 | 6225 | 1.2 | 0.2 | 1.3 | 0.3 | 1.6 |
| 3 | 2500 | 789 | 1.3 | 0.4 | 1.7 | 0.1 | 1.9 |
| 4 | 4000 | 599 | 1.5 | 0.3 | 1.8 | 0.4 | 2.3 |
| 5 | 10000 | 928 | 2.7 | 0.5 | 3.1 | 0.7 | 3.8 |
| 6 | 15000 | 1948 | 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 per cent per year over the three year period from 1992 to 1994. Most of the decline occurred in group A. Here the cattle numbers fell by 2.9 per cent 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 of cattle population is to increase on average by 2.5 per cent per year, with a range of from 1.9 to 8.4 per cent 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 per cent 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 per cent from 3.2 litres per head per day.

Some important conclusions of the discussion above are :

- 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 be viable. On the basis of the 1994 population of cattle, farmer numbers would need to fall by between 40 and 50 per cent for the target to be reached.

**Table 9.5 Trends of farmers, cattle, and fresh milk production of KUD in East Java, 1992–1994**

| Item | Unit | 1992 | 1993 | 1994 | Growth rate 1992-1994 |
|---|---|---|---|---|---|
| | | | | | (%) |
| Group A | | | | | |
| - Farmer | no. | 14894 | 14045 | 14045 | –2.9 |
| - Population | no. | 53069 | 53300 | 55036 | 1.9 |
| - Production | l. | 178771 | 191952 | 194992 | 4.5 |
| - Production/farmer | l. | 12.0 | 13.7 | 13.9 | 7.8 |
| - Production/population | l. | 3.4 | 3.6 | 3.5 | 2.6 |
| - Population/farmer | no. | 3.6 | 3.8 | 3.9 | 5.0 |
| Group B | | | | | |
| - Farmer | no. | 1948 | 1948 | 1948 | 0.0 |
| - Population | no. | 3928 | 3785 | 3785 | –1.8 |
| - Production | l. | 16232 | 19295 | 20616 | 13.5 |
| - Production/farmer | l. | 8.7 | 9.9 | 10.6 | 13.5 |
| - Production/population | l. | 4.1 | 5.1 | 5.4 | 15.9 |
| - Population/farmer | no. | 2.0 | 1.9 | 1.9 | –1.8 |
| Group C | | | | | |
| - Farmer | no. | 3416 | 3416 | 3416 | 0.0 |
| - Population | no. | 7520 | 7938 | 8785 | 8.4 |
| - Production | l. | 30919 | 38323 | 41214 | 16.6 |
| - Production/farmer | l. | 9.1 | 11.2 | 12.1 | 16.6 |
| - Production/population | l. | 4.1 | 4.8 | 4.7 | 7.1 |
| - Population/farmer | no. | 2.2 | 2.3 | 2.6 | 8.4 |
| Group D | | | | | |
| - Farmer | no. | 6759 | 6874 | 6870 | 0.8 |
| - Population | no. | 20416 | 20960 | 21504 | 2.7 |
| - Production | l. | 48039 | 58279 | 68075 | 20.9 |
| - Production/farmer | l. | 7.1 | 8.5 | 9.9 | 19.7 |
| - Production/population | l. | 2.4 | 2.8 | 3.2 | 17.3 |
| - Population/farmer | no | 3.0 | 3.0 | 3.1 | 1.8 |
| Total | | | | | |
| - Farmer | no. | 27017 | 26283 | 26279 | –1.4 |
| - Population | no. | 84933 | 85983 | 89110 | 2.5 |
| - Production | l. | 273961 | 307849 | 324897 | 9.3 |
| - Production/farmer | l. | 10.1 | 11.7 | 12.4 | 11.0 |
| - Production/population | l. | 3.2 | 3.6 | 3.6 | 6.5 |
| - Population/farmer | no. | 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 other businesses that the KUDs are involved in include milk processing, feed stuff processing and supply, fertiliser 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 business.

The farmers are independent milk producers because they have to decide anything related to their business 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 fresh milk produced by the farmers. Although the farmer is under no contractual obligation to do so, in practical terms each farmer has to sell their fresh milk to the KUD of which they are a member. 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 monosopnistic 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 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 that of the farmers or KUDs.

### Cost Structure

As mentioned previously, the 13 KUD were selected using stratified random sampling. Six strata were defined on the basis of daily production. These were 500 litres, 1500 litres, 2500 litres, 5000 litres, 10,000 litres and 15,000 litres.

- It can be seen from Table 9.6 and Table 9.7 that the cost to the KUD vary 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 quality difference of 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.

There are two main factors affecting the farm gate price of fresh milk.

- The first of these is the quality of the fresh milk, where quality is determined by density and fat content. The higher the fat content, the higher the price of fresh milk. However, fresh milk price based on this quality is difficult to implement. Fat content and water content are recorded every morning and afternoon in the collecting points. On the other hand, 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 also measure the fresh milk quality. The fresh milk quality measurement is for all 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 KUD. The KUDs then pass on this price to the farmers, less costs.

- The costs incurred by the KUDs for all of their businesses are financed 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 there are three groups making losses. These were the smallest (500litres per day), and the medium sized KUDs (2500 litres per day and 4000 litres per day). In each annual report of the KUD, almost all dairy cattle business units are profitable, but overall KUD's business generate losses. This is due to the costs expended by KUD to carry out all their activities. Obviously, the co-operatives did not produce these milk volumes exactly on any particular day. Rather, the production levels used to stratify the opulation were approximate and represent "average" daily production.

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

| Item | Daily production | | | | | |
|---|---|---|---|---|---|---|
| | (500 l.) | (1500 l.) | (2500 l.) | (4000 l.) | (10000 l.) | (15000 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 KUD**

| Item | Daily production | | | | | |
|---|---|---|---|---|---|---|
| | (500 l.) | (1500 l.) | (2500 l.) | (4000 l.) | (10000 l.) | (15000 l.) |
| Salaries and bonus | 12 | 21 | 22 | 18 | 18 | 15 |
| Organisation 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 profits 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 are Rp 220 million, it is not distributed just to the dairy farmers. The profit belongs to the KUD and the KUD officials may utilise 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 etc. The KUD generally uses more of the profits to operate the business of the KUD, not to improve the farming operations of the members. This is in accordance with business principles of the KUD. 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 dairy business unit were to be minimised, 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 operation.

**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 | 2261044 | 348112 | 132014 | 1559979 | 2040104 | 220940 |
| Electricity | 9382 | 7373 | 899 | 0 | 4272 | 5110 |
| Price | 111908 | 472 | 83 | 106909 | 107464 | 4444 |
| Soybean cake | 11137 | 958 | 1807 | 4455 | 7219 | 3918 |
| Credit | 7356 | 2827 | 2558 | 0 | 3385 | 1971 |
| TVRI tax | 3045 | 1535 | 300 | 0 | 1836 | 1209 |
| Sugar | 30718 | 2496 | 307 | 27819 | 30622 | 96 |
| TRI | 411 | 461 | 65 | 0 | 526 | –114 |
| KUT | 240 | 3 | 366 | 0 | 369 | –129 |
| Food | 41595 | 3159 | 191 | 38466 | 41817 | –221 |
| Fertilisers | 126080 | 6498 | 647 | 121241 | 128386 | –2306 |
| Cipro | 267630 | 5668 | 44 | 275221 | 280933 | –13303 |
| General | 15612 | 99207 | 88313 | 7852 | 195372 | –179760 |
| Total | 2886159 | 474768 | 227593 | 2141943 | 2844305 | 41855 |

## CONCLUSION AND POLICY IMPLICATIONS

In East Java during the three year period 1992 to 1994, there were 80 KUDs, of which 65 per cent are either very weak or inactive. There was little or no increase in total members, and in the cattle population. Most dairy farmers have only one lactating cow with a production rate of 3000 litres per year or less. This is the main reason why milk production levels in East Java have only grown slowly.

At the KUD level, some findings are as follows :

- Total costs for fresh milk production vary among KUD and there is no clear relationship between scale and expenses. It could be concluded that the KUD business may not be efficient and has a number of different structures in different KUD.

- 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. KUDs apparently prefer to increase total members and total cattle to expanding 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 monosopnistic fashion.
- The profits from the dairy cattle business unit are not distributed to the farmers. KUDs have many activities involving a range of inputs and a variety of different outputs. Profit

distribution is the authority of KUD and its management is not obligated 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 of 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 subsidising less profitable business units. An alternative to having the co-operative specialising only in dairying would be to operate each business unit separately to other business units. This would require tight financial control at the co-operative level to ensure costs are assigned to the enterprise incurring 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 programs to increase the production of milk the GKSI 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

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Smallholders farming accounts for 95 per cent of the total livestock population, while large scale private enterprises account for the remaining five per cent. Large scale poultry, swine farming and – only recently – beef cattle fattening on feedlots are most attractive to private sector firms. Accordingly, government policies towards increasing livestock production have focussed 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 nutrition 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 which may influence other countries include those affecting trade in livestock products, the consumption of livestock products, as well as macroeconomic factors such as fiscal and monetary policies. In order to gain more benefit from livestock, livestock production and livestock inputs trading between countries at the regional or international market, identification of the interests of each country becomes necessary, 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 may produce low priced products due to favorable resource endowments (leading to low costs) or because of low domestic demand relative to domestic supply. This country would 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. These include price and income enhancement for producers; as a way of subsidising consumer prices; and a source of taxation revenue. Intervention, whether on 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 market by enforcing price controls or subsidizing various products to keep retail prices low. Since livestock products such as meat, milk and eggs are important in family expenditure, 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 reached at least 10 per cent per year and continues to increase even when the agricultural sector's contribution to the 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. Poultry products were also imported by Indonesia 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 Program (*Bimas*) being launched nationally around 1979. Up until 1990, domestic beef production satisfied demand, but imports of meat and feeder cattle started to increase beginning in 1991. Domestic milk production has only been able to satisfy 35 per cent of the national demand and about 65 per cent is imported.

Demand for livestock products in Indonesia has grown because the income elasticity of demand for livestock products (meat, eggs and milks) 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 trends of a shortfall in the demand and supply of livestock products through issuing new regulation and 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 fluctuation. As examples, (a) commercial credits can be obtained by individual farmer from the bank, (b) the *Bantuan Presiden* (*Banpres*) or presidential aid, presidential instruction (*Inpres*) and cash programs are provided for smallholders and poor farmers, (c) government program on livestock development, and (d) livestock projects funded through foreign aid.

## INVESTMENTS IN LIVESTOCK SUB-SECTOR

The complexity and length of time required for licensing has slowed investment in the livestock sub-sector. The level and growth rate of investment in livestock in Indonesia is 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 which are seeking special consideration such as tax and import duty relief. In a recent four year period, the levels of BKPM recorded investment in livestock sub-sector from domestic (PMDN) 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 animal since 1970s when export of live cattle to Hong Kong occurred. Nowadays, the government allows only day old chickens (DOC) 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 IMTGT (Indonesia, Malaysia, Thailand Growth Triangle) memorandum between the three countries. Imports of live beef and dairy cattle, feeder steers, breeding pigs, DOC 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 to 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 increases from 12700 to 26100 tonnes

**Poultry**

Exports have fallen because of the rapid growth in poultry consumption. Indonesia exports DOC but the number has decreased from some 702,000 heads in 1991 to 76,700 heads in 1995. Imports of parent stock DOC increased from 254,700 heads in 1991 to 1,500,000 heads in 1995 due to the increase in domestic demand of 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 land. The rate of increase in demand for beef has been faster than Indonesia's ability to produce beef and therefore meat imports 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 due to a greater supply of meat from the broiler and layer industry as a result of the *Bimas* program.

The increase in beef consumption has also stimulated the fattening business to produce meat through importing feeder cattle 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 to 407,000 head in 1997. Feeder steers are more uniform in size and quality and supply is more certain compared to 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 imported feeder cattle 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 sourced from Australia reflects the inability of the local industry to supply feeder cattle.

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

exchange rate was Rp 2,400.00 per US dollar, locally purchased cattle could not compete with imports. (The local cattle sold at Rp 3700 per kg live weight).

However, beginning in July 1997 when the exchange rate depreciated, to reach Rp 16,000.00 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 and therefore able to purchase directly from farmers. Direct purchasing costs a lot less than purchasing through the traders: for instance, the live weight price from on farm purchase may be as low as A $ 1.10 per kg or US$ 0.80 per kg. The trade in feeder steers is still uncertain since it depends on the exchange rate. At Rp 5,000.00 per US dollar, the price from Australian traders was US$ 1.05, which is equivalent to Rp 5,250.00 per kg. This is more expensive than local cattle since these cost Rp 4,800.00 per kg live weight.

**Sheep and Goats**

Some 30 per cent of the world's small ruminant population is 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 Oceanic 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 advantages of these countries in small ruminant trade. During the period 1989 to 1992, the CIFs for small ruminants meat in world market 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. When the domestic price is far beyond the CIF, it would be impossible to export without a subsidy. Some countries in Asia have been net importers of small ruminants and accounted for 11.7 million head or about 51 per cent of the total world's imports in some years. These countries are in the Middle East, particularly Saudi Arabia, the United Arab Emirates, and Syria where the imports are the highest in Asia.

In many regions of Indonesia, animals are an important component of farming activities, particularly for the smallholder. Year round, farmer needs are provided from food crop production, with the primary reason for keeping animals being for storing capital or as a way of generating a cash income. The role of animals within the farming activities is well demonstrated by small ruminant which are mostly kept by farmers on the island of Java. Sheep and goats are raised with minimal inputs and low maintenance costs. They utilise and recycle waste products from cropping activities. Furthermore, they have a relatively high reproductive rate and always have a ready market. On-farm productivity of small ruminant is considered low compared to that obtained at experimental stations. Thus, increasing on-farm productivity could enhance national efforts to increase rural income as well as the level of national protein consumption. Further, the economic implication of increased small ruminant productivity is apparent in view of their wide distribution among smallholder.

There are two specialized small ruminants markets in Saudi Arabia; these are the requirement of complete rams for sacrifice and the strong consumer preference for fat-tailed sheep. An interesting aspect of this market is the price differentials for different classes of sheep and goats in Saudi Arabia. Australian sheep dominate the market retail and sell for about US$ 48 to 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 cost of import (CIF) price varies between countries and fluctuates. The variability of the CIF price might be due to breed, age and live weight as well as the cost of freight and insurance. Similar reasons are probably behind price fluctuation 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, tends to have monopsonistic power in determining price at the time the animals reach the port of entry. Import 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, live weight and other trade specification. Information on the CIF price is very important for a country like Indonesia 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 export price (FOB) 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 Oceanic (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 advantages and provides a competitive advantage in the world's small ruminant trade.

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

Between 1989 and 1992, the CIFs for small ruminant meat in world market were relatively stable compared to that of live animal and there were only small variations between countries. The highest CIF prices were in the European countries while those in Oceanic 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 pig is very 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 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 will import 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 license was issued by the government of Indonesia through the Decree of Minister of Agriculture No. 406/Kpts/019/6/1980 on foreign investment. The licence would be issued after meeting the technical requirements in accordance to 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 like Malaysia, China, Thailand and Vietnam. The basis for competition is product quality. There are three types of live pigs exported: suckling pigs weighing 3 to 5 kg per head, weaned pigs weighing 60 to 70 kg per head, and finished pigs weighing 95 to 105 kg per head. Indonesia could not compete in quality and price with other countries of weaned and finished pigs, 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 compared to weaned and finished pigs. The advantages of concentrating on suckling pigs production are three fold: (1) separating suckling pigs from the sow stimulates faster mating (two and two and a half times a year); (2) barns are used for a shorter period; and (3) faster generation of income for the enterprise.

A problem with the export of weaned and finished pig 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. More frequently, the pigs sent to Singapore market do not go through the auction. Therefore, they have to be sold at whatever price that 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 because many commercial. No doubt this is also true for the traditional pig farmers. Traditional pig farmers experience difficulties in obtaining export certificates. This has forced the traditional farmers to go out of business as a result of their inability 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 284000 head in 1991 to 161,000 heads in 1995, while imports of breeding pigs decreased from 4300 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 as much as five times 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 1867 tonnes in 1991 to 7259 tonnes in 1995. In addition, offal (mainly liver) imports increased from 3,665 tonnes in 1991 to 12,000 tonnes in 1995. Beef exports were only about 20 tonnes 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 tonnes in 1991 to 737 tonnes in 1995. The export of small ruminant meat was about 200 tonnes in 1994, after several small export volumes in the late 1980s.

**Dairy**

The need to develop the dairy industry is not only a classic economic process to meet the domestic demand for milk but is also in line with the government objectives to increase farmers income; to spread the distribution of income; to create employment opportunities; to increase foreign exchange earning; and to improve 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 a large portion of dairy products are used as raw material by other industries. Expansion of dairy production is expected to reduce milk and milk products imports and lead to exports of processed dairy products in those cases 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 1970s to support milk processing industry. At the start, the milk processing industry in Indonesia produced only sweetened condensed milk. Later 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 the dairy industry expansion 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 importing some 110,000 dairy cows from Australia and New Zealand between 1979-1990, resulted in the production of milk increasing from 204,000 tonnes to 329,000 tonnes.

Despite the increasing level of milk production, only 35 per cent of milk comes from domestic production, with the rest imported. This amounted to 533,000 tonnes in 1993 and 1,026,200 tonnes 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*), (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 that agreed upon during the APEC meeting in Bogor (*the Bogor Declaration*) that set 2003 as the deadline.

Apart from a short period covered by the regional monetary crisis, the high demand for milk and milk products resulted in a far lower local milk price than the world market price. Hence, consumers are now looking at local fresh milk and *pasteurized* milk in place of

powder milk and other processed milks. In addition, the low exchange rate between Indonesian *Rupiah* and the US dollar, made domestic milk and milk product prices even lower. The question is whether this means that the domestic milk production is now having a greater competitive advantage over imported one ?

**Broilers**

Poultry farming is most important in the livestock sector in Indonesia, and the demand for poultry products is very high. However, raising broiler and layer chicken is relatively new to Indonesia, starting in the 1970s through the *Bimas* program. The rapid increase in broiler production has outpaced beef production since 1979. Presently the domestic market for broilers has been saturated by the large production volume, in line with the national campaign of increasing non-oil exports. It may be one of the reasons why the price of broilers fell drastically in recent years. Export of broilers is expected to increase each year. Statistics show some 213,400 tonnes was exported in 1991 growing to 1,000,400 tons in 1995.

**Eggs**

At the same time as broiler production was being developed in the 1970s, modern layer poultry farms producing eggs were also grown to be highly specialised operations. There are high concentrations of layer chickens in West Java due to its proximity to large markets around the big cities including Jakarta. These are the largest market for chicken eggs. Hence, the supplying inputs to farms factories as well as feed industries are located near the production centres. Exports of eggs from Indonesia are small and negligible, and started in 1986. Then the production of eggs for consumption was only 6 tonnes and it jumped to 55 tonnes 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. These were for hatching, for fresh consumption and 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 reduction in export volumes 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 skin mainly from ruminant animals is a prospective export commodity. Exports increased from 1578 tonnes in 1991 to 2958 tonnes in 1995, while bones and horn exports decreased from 4124 tonnes in 1991 to 1706 tonnes in 1995. The increase in skin exports is indicative of the increasing number of ruminant animals being slaughtered. However, imports of leather have been incredibly high and 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 is generally in 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 fattening involving beef, cattle and sheep and dairy cattle operations also use concentrate feeds. Poultry and swine enterprise use

concentrate feed, 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, were not given the same level of assistance. Up until 1997, BULOG controlled the trade of corn, soybean, soybean cake and fishmeal most of which is imported. Domestic markets of these feed stuffs 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 to 60 per cent 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 other parts in 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 tonnes and these increased to 169,398 tonnes in 1987. Corn exports fluctuate with the season and occur at harvest time season when the domestic price falls. Exports began in 1970 when 282,196 tonnes were exported, but these had decreased to only 50,723 tonnes in 1975.

Most domestic corn is for human consumption, but the share is decreasing (70 per cent in 1970 and 56 per cent in 1986). The share of corn in livestock feed has increased from 15 per cent in 1970 to 44 per cent in 1985, and industrial use has been steady at 3.4 per cent in 1970 and 3.6 per cent in 1986. Before 1980, the food balance sheets (FBS) estimated 2 per cent of corn went to livestock feeds, but it was later adjusted upward to 6 per cent. In 1995 it was estimated that 547,000 tonnes of corn, or about 6 per cent of domestic supply of 9,113,000 tonnes were used as livestock feeds. According to the Directorate General of Livestock Services (DGLS) in 1996 Indonesia's 60 largest feed mills used 3,551,190 tonnes, six times the estimate of the FBS, while actual use by these same large feed mills was 40 per cent of availability in 1995.

**Soybean**

Another important feed ingredients as a protein source is soybean. 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, since 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 per cent per year.

For soybeans, the FBS approach derived the 1995 consumption estimate by adding domestic production of 1,689,000 tonnes to imports of 607,000 tons, plus stock changes. Imports of soybean cake for livestock feed were almost equal in value to the value of import 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. They 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 dosage in 1991 to 1,564 million dosage in 1995, while imported products rose from 1029 million dosage (1991) to 2,679 million dosage (1995). Imported vaccines for ruminants (small and large) represent a smaller portion of the total available biological products. They numbered 88,000 dosage in 1991 and 76,300 dosage in 1995. The total value of imported veterinary medicines increased slightly from Rp 100,739 million 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 medicines veterinary products reflects the government emphasis towards reducing Indonesia's dependency on veterinary medicines supply from 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 centers 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 development effort to improve livestock production for domestic consumption, has to take international trade in livestock and livestock product into consideration in determining where its comparative advantage lies.

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## Table 10.1 Production, consumption, exports and imports of livestock products, Indonesia, 1994 – 1996

| Products | 1994 | | | | 1995 | | | | 1996 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Supply | | Demand | | Supply | | Demand | | Supply | | Demand | |
| | Prod. | Import | Cons. | Export | Prod. | Import | Cons. | Export | Prod. | Import | Cons. | Export |
| | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) | (t.) |
| **Meat** | 1,492.944 | 15,677 | 1,508.464 | 1,107 | 1,564.282 | 17.255 | 1,581.462 | 1,020 | 1,671.900 | 23,100 | 1,691.080 | 1,020 |
| Beef Cattle | 366,461 | 12,707 | 349,161 | 4 | 339,426 | 14,579 | 354,006 | 20 | 342,300 | 20,600 | 359,040 | 20 |
| Buffaloes | 48,196 | 0 | 48,196 | 0 | 46,753 | 0 | 46,753 | 0 | 44,700 | 0 | 44,700 | 0 |
| Goats | 57,066 | 493 | 57,566 | 0 | 61,154 | 589 | 61,744 | 0 | 65,600 | 700 | 66,300 | 0 |
| Sheep | 42,621 | 0 | 42,621 | 0 | 44,711 | 0 | 44,711 | 0 | 47,200 | 0 | 47,200 | 0 |
| Swine | 183,633 | 151 | 183,653 | 0 | 194,415 | 85 | 194,425 | 0 | 208,300 | 0 | 208,300 | 0 |
| Horse | 2,332 | 0 | 2,332 | 0 | 1,476 | 0 | 1,476 | 0 | 1,600 | 0 | 1,600 | 0 |
| N. | 282,054 | 0 | 282,054 | 0 | 299,239 | 0 | 299,239 | 0 | 317,400 | 0 | 317,400 | 0 |
| Chickens | 22,593 | 0 | 22,593 | 0 | 21,691 | 0 | 21,691 | 0 | 21,300 | 0 | 21,300 | 0 |
| Layer | 498,527 | 2,315 | 500,827 | 1,103 | 536,002 | 2,002 | 538,002 | 1,000 | 604,200 | 1,740 | 605,940 | 1,000 |
| Broiler | 19,461 | 0 | 19,461 | | 19,415 | | 19,415 | | 19,200 | | 19,300 | |
| Ducks | | | | | | | | | | | | |
| **Eggs** | 688,623 | 59 | 602,800 | 7 | 728,789 | 42 | 638,600 | 12 | 785,000 | 42 | 688,500 | 12 |
| N. | 119,544 | 0 | 59,800 | 0 | 127,945 | 0 | 63,900 | 0 | 136,900 | 0 | 68,500 | 0 |
| Chickens | 423,457 | 59 | 419,200 | 7 | 457,011 | 42 | 452,400 | 12 | 493,100 | 42 | 488,200 | 12 |
| Layer | 145,633 | 0 | 123,000 | 0 | 143,833 | 0 | 122,300 | 0 | 155,000 | 0 | 131,800 | 0 |
| Ducks | | | | | | | | | | | | |
| **Milks** | | | | | | | | | | | | |
| Dairy Cattle | 426,277 | 533,180 | 906,600 | 11,300 | 432,937 | 974,600 | 1,353,400 | 31,000 | 457,900 | 1,026.200 | 1,374.700 | 45,300 |

Source: Wiryosuhanto, S. (1997)

# APPENDIX: THE INDONESIA FEED AND LIVESTOCK SECTOR, A STATISTICAL OVERVIEW

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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 ON 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% between 1971 (when Indonesia's population was 119 million people) and 1980 while for the period 1990 (when there were 179 million Indonesians) to 1995, the growth rate was 1.66% per year. Over 100 million people live on Java, an island with an area of about 132 000 $km^2$ . Indonesia's overall land area is 1 919 317 $km^2$ 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 $94^0$ to $141^0$ east longitude

Levine (1982) classifies Indonesia into inner islands (Java, Bali and Madura) and the outer islands (Sumatera, Kalimantan, Suliwesi, 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 podzollic 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 Tengarah (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% of Indonesia's area. About 60% of Indonesia's population live in Java, resulting in a very high population density of 814 people per $km^2$ in 1990 and 868 per $km^2$ 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% of Indonesia's land area, making it the largest of Indonesia's islands. It has one of the lowest population density and is relatively undeveloped (Table 1).

**Table 1 Percentage of population and density per km$^2$ 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 |
| Bengkuku | 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 | 7762 | 11023 | 12495 | 15445 |
| 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 Indonesia (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% in the early 1970s, but it had fallen to about 16% in 1995 (Biro Pusat Statistik 1996).

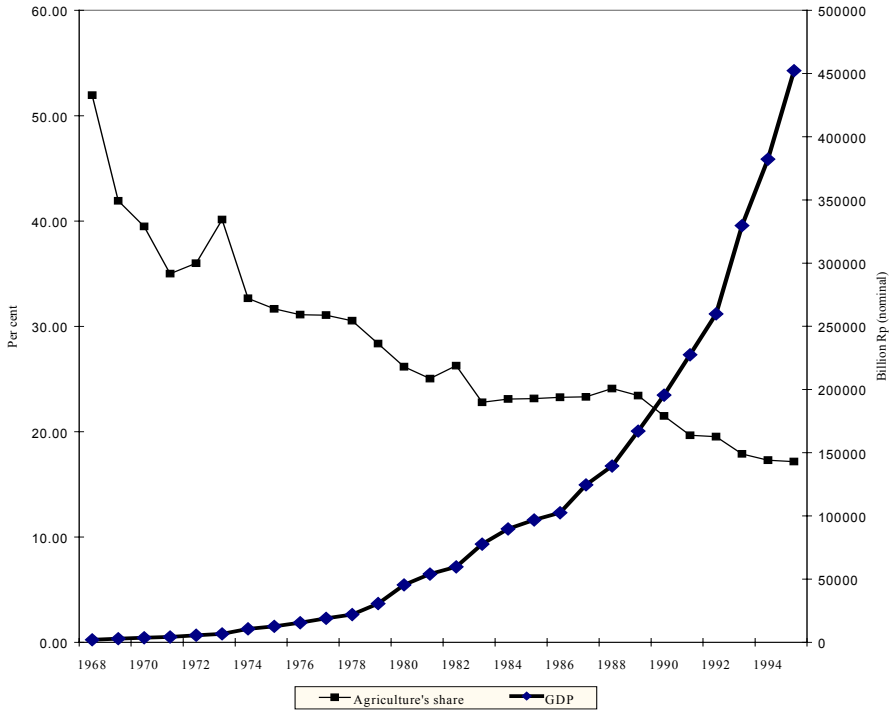


**Figure 1 Nominal GDP and agriculture's share of GDP**

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 doubts exist whether this will be the case in the future. El Nino 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% and 11% of agriculture, and around 2% of GDP (Figure 2).

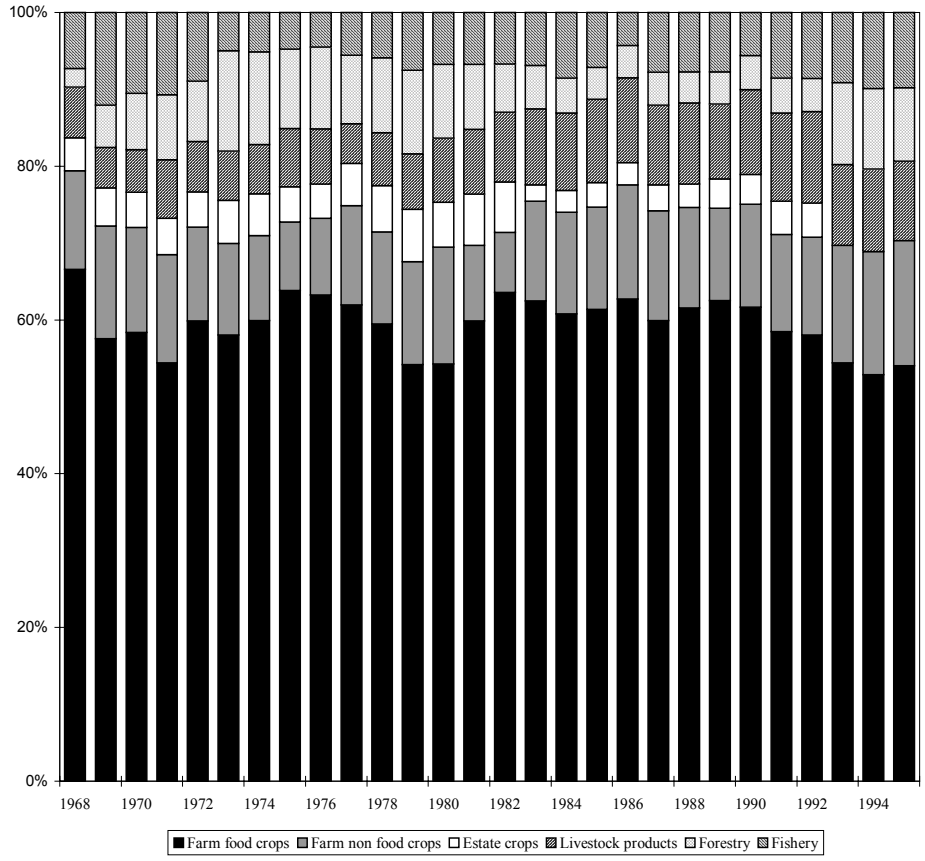


**Figure 2 Contribution of agricultural industries to total agricultural output**

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 programs 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 household and area of land under the 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 | 3,1559.9 | 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 |
| Bengkuku | 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% of farm households in 1993 had livestock, whereas in 1983, just on 23% of households had livestock. The provinces where the greatest proportion of households had livestock in 1993 were Bali (58%), Nusa Tenggara Timur (45%), Timor-Timur (45.8%), Irian Jaya (41%) and Nusa Tenggara Barat (37.2%). 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% of Indonesia's agricultural output, while in 1995, their contribution was 44.3%. Sumatera Utara, Sulawesi Selatan and Sumatera Selatan were the next most important with a combined contribution of 17% and 17.94% in 1991 and 1995, respectively. Timur-Timur, Bengkuku 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 Acch | 1470.9 | 1813.1 | 1906.2 | 2385.5 | 2987.5 |
| Sumatera Utara | 4141.9 | 4995.0 | 4895.7 | 5494.8 | 6165.5 |
| Sumatera Barat | 1162.5 | 1271.4 | 1313.1 | 1545.0 | 1725.6 |
| Riau | 839.1 | 929.8 | 1252.1 | 1378.0 | 1574.1 |
| Jambi | 535.9 | 604.4 | 708.7 | 833.9 | 973.0 |
| Sumatera Selatan | 1582.0 | 1772.2 | 2015.3 | 2450.7 | 3242.9 |
| Bengkuku | 357.8 | 411.5 | 464.0 | 648.4 | 773.4 |
| Lampung | 1462.1 | 1771.2 | 1993.7 | 2460.6 | 3178.2 |
| DKI Jakarta | 232.5 | 197.6 | 144.4 | 141.1 | 151.0 |
| Jawa Barat | 7826.2 | 8745.2 | 9107.8 | 10344.5 | 11453.0 |
| Jawa Tengah | 7572.2 | 8498.4 | 7810.6 | 8778.9 | 10414.5 |
| DI Yogyakarta | 597.0 | 675.6 | 699.9 | 855.8 | 945.4 |
| Jawa Timur | 8368.4 | 9381.8 | 9670.0 | 10302.4 | 11336.1 |
| Bali | 1166.7 | 1253.1 | 1253.8 | 1357.3 | 1485.6 |
| Nusa Tenggara Barat | 748.1 | 856.6 | 974.3 | 1152.9 | 1325.1 |
| Nusa Tenggara Timur | 681.4 | 768.5 | 858.0 | 998.2 | 1143.8 |
| Timor-Timur | 130.6 | 149.0 | 153.6 | 186.8 | 208.7 |
| Kalimantan Barat | 877.1 | 957.9 | 1291.0 | 1491.2 | 1768.0 |
| Kalimantan Tengah | 562.3 | 652.8 | 1126.8 | 1469.9 | 1771.3 |
| Kalimantan Selatan | 697.1 | 838.9 | 1123.1 | 1250.8 | 1444.0 |
| Kalimantan Timur | 1066.8 | 1141.6 | 1677.7 | 1820.8 | 2066.3 |
| 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 | 2239.5 | 2639.0 | 2865.6 | 3354.2 | 4028.9 |
| 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 | 1114.8 | 1284.2 |
| Indonesia | 46860.2 | 53110.4 | 56863.6 | 64852.2 | 74950.9 |

Notes: 1994 are preliminary figures, 1995 are very preliminary
Source: Direkto Jenderal Peternakan (1997), p.7.

To see which provinces were most heavily dependent upon agriculture, the percentage of each regions' 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% 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% 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 Acch | 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 |
| Bengkuku | 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

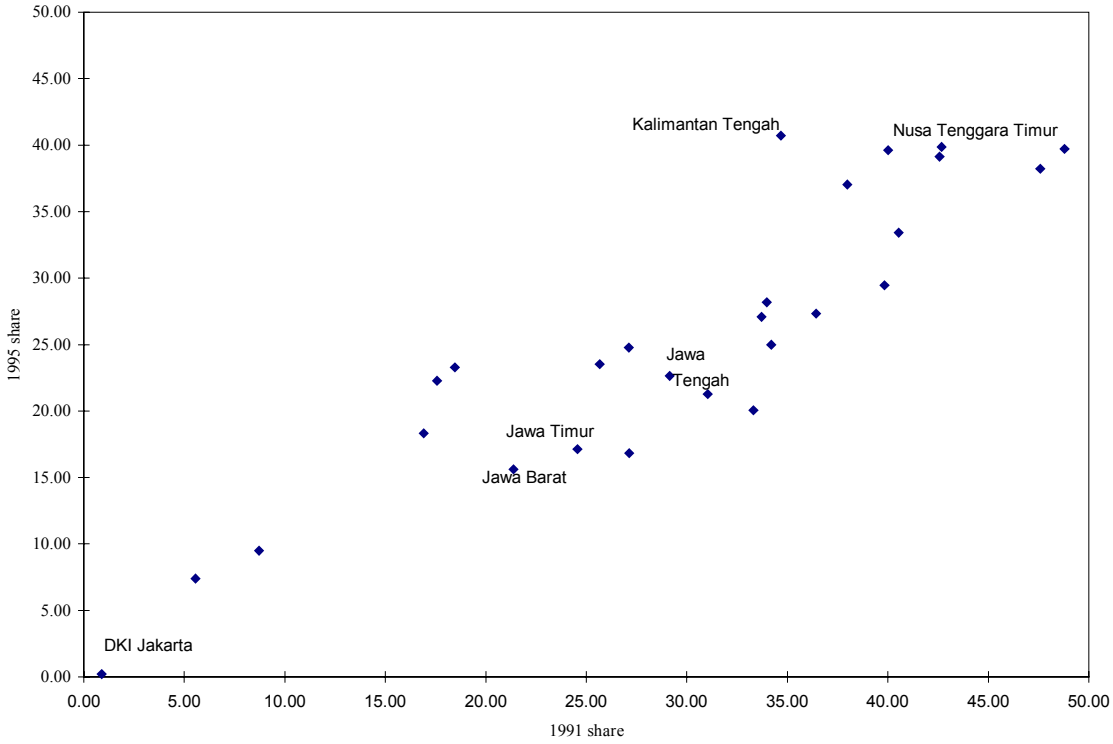


**Figure 3 Agriculture's share of regional GDP, 1991 and 1995**

## 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%, 16.3% and 18%, 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% of Indonesia's livestock production was the most important, followed by Jawa Tengah (16.8%) and Jawa Barat (11.61%). The other 24 provinces accounted only for around 50% of livestock output. Kalimantan Selatan, Maluku, Timur Timur and Irian Jaya each had less than 0.5% of Indonesia's livestock output in 1991. For Timur Timur and Maluku the situation was similar in 1995, with the contribution of each still being less than half a per cent. Table 6 shows the livestock GDP in each of the 27 provinces in each of 1991 to 1995 while Figure 4 shows 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 Acch | 134937 | 169429 | 242189 | 323065 | 455150 |
| Sumatera Utara | 445135 | 608170 | 498830 | 586754 | 682102 |
| Sumatera Barat | 86790 | 103191 | 155795 | 167355 | 191373 |
| Riau | 46777 | 55410 | 59556 | 73963 | 93448 |
| Jambi | 79317 | 85857 | 73936 | 89720 | 100433 |
| Sumatera Selatan | 107402 | 123803 | 176989 | 212351 | 242805 |
| Bengkuku | 43791 | 49798 | 56933 | 64205 | 74953 |
| Lampung | 210872 | 253990 | 331319 | 386841 | 453939 |
| | | | | | |
| DKI Jakarta | 108909 | 91702 | 14499 | 14921 | 12312 |
| Jawa Barat | 555801 | 978191 | 1172930 | 1361526 | 1591967 |
| Jawa Tengah | 805654 | 989819 | 1062481 | 1208380 | 1409655 |
| DI Yogyakarta | 105486 | 123047 | 111183 | 130958 | 142970 |
| Jawa Timur | 857971 | 959888 | 900665 | 1148773 | 1446605 |
| | | | | | |
| Bali | 298029 | 334035 | 306237 | 337104 | 366967 |
| Nusa Tenggara Barat | 103516 | 122881 | 128116 | 144210 | 163200 |
| Nusa Tenggara Timur | 151541 | 176387 | 201784 | 259533 | 298184 |
| Timor-Timur | 17536 | 21651 | 19791 | 20299 | 22024 |
| | | | | | |
| Kalimantan Barat | 89679 | 99095 | 128531 | 140474 | 169067 |
| Kalimantan Tengah | 28745 | 171135 | 39385 | 51234 | 62976 |
| Kalimantan Selatan | 9794 | 60594 | 62765 | 80695 | 90598 |
| Kalimantan Timur | 78812 | 99305 | 110468 | 160262 | 205576 |
| | | | | | |
| Sulawesi Utara | 55148 | 60624 | 58749 | 69020 | 86532 |
| Sulawesi Tengah | 43231 | 60826 | 78980 | 107915 | 131955 |
| Sulawesi Selatan | 230924 | 271204 | 126108 | 137304 | 136119 |
| Sulawesi Tenggara | 50230 | 41314 | 49092 | 63113 | 97301 |
| | | | | | |
| Maluku | 15662 | 198180 | 20492 | 24577 | 31355 |
| Irian Jaya | 23679 | 25603 | 67932 | 79057 | 91361 |
| | | | | | |
| Indonesia | 5126200 | 6040700 | 6202700 | 7102300 | 7998500 |

Notes: 1994 are preliminary figures, 1995 are very preliminary
Source: Direkto Jenderal Peternakan (1997), p.5.

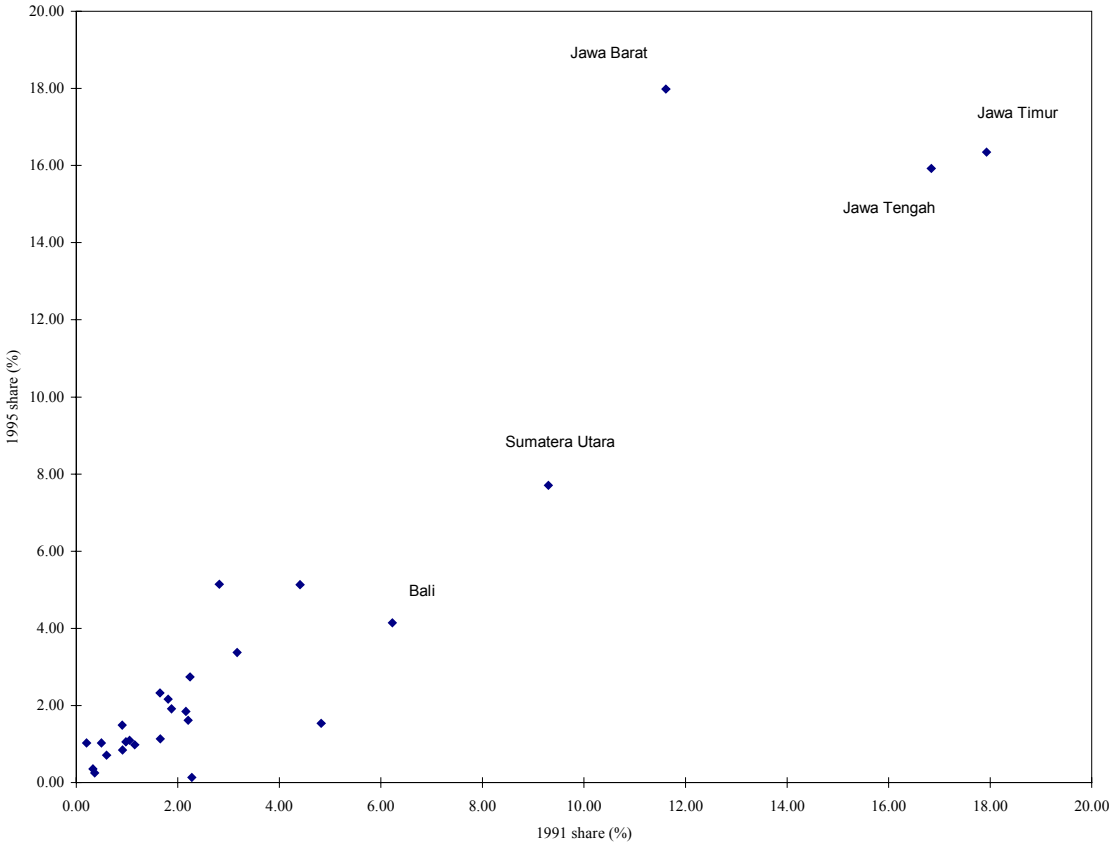


**Figure 4 The contribution of regions to Indonesia's livestock production, 1991 and 1995**

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

| Provinces | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|
| | (%) | (%) | (%) | (%) | (%) |
| DI Acch | 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 |
| Bengkuku | 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

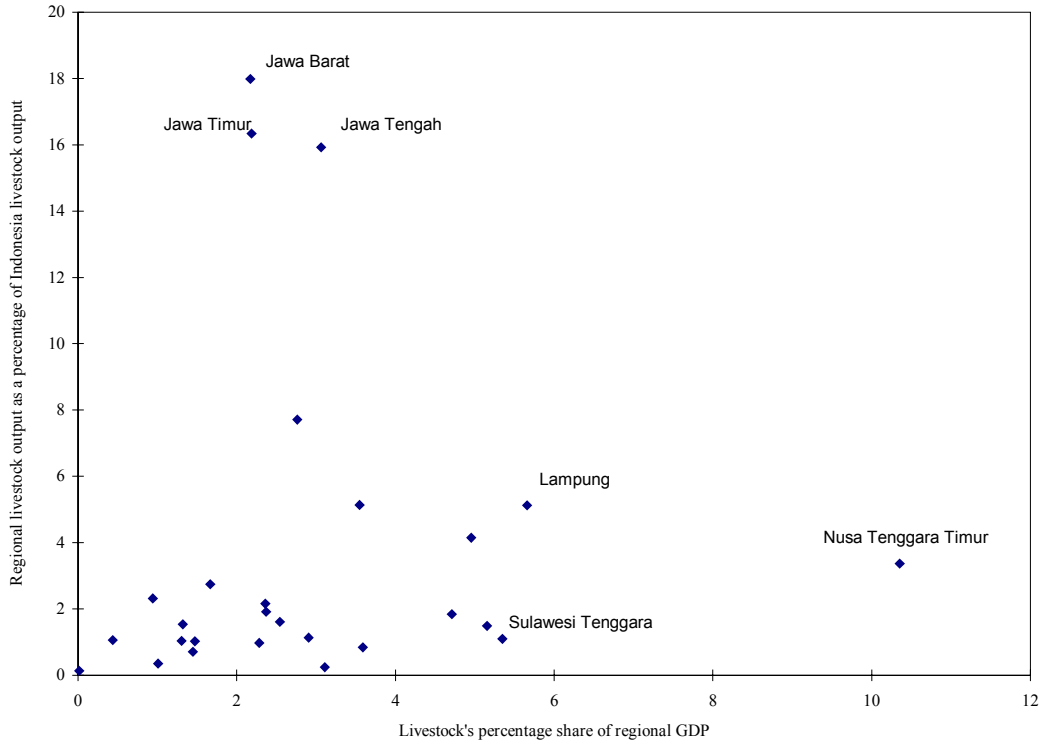


**Figure 5 The relationship between the importance of the regions to Indonesia's livestock output and the importance of livestock to each region's GDP, 1995**

## 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 more than seven times from 1 296 000 to over 9 000 000 (Figure 6).

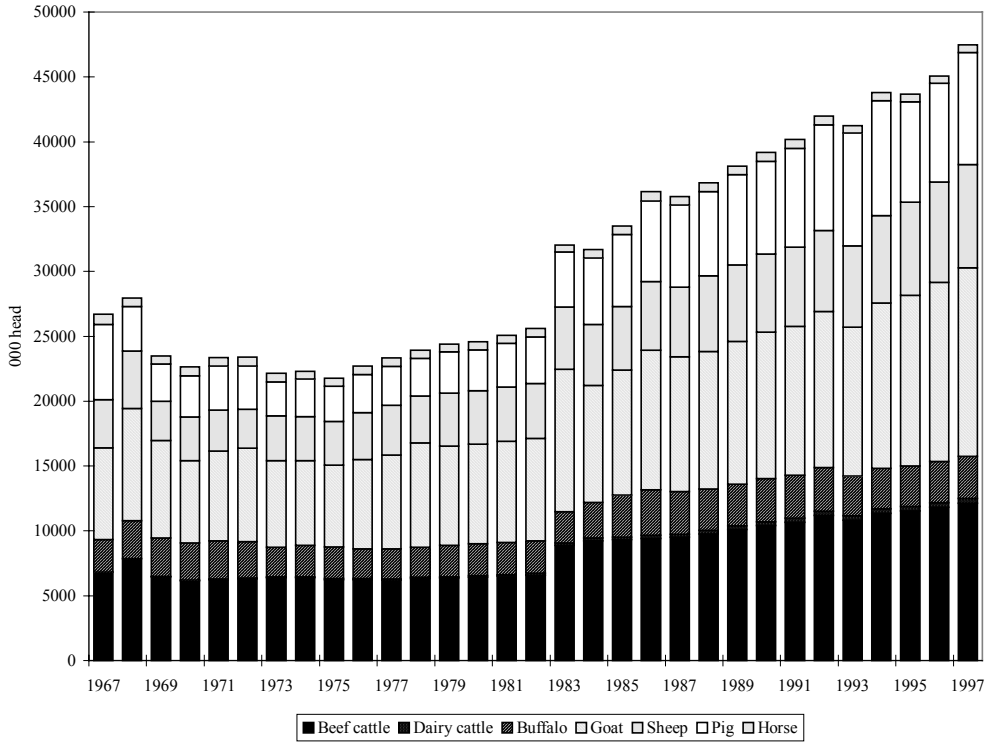


**Figure 6 Number of four footed animals, 1967 to 1997**

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 program. A similar program was tried for livestock - the "Bimas of Livestock". When first set up, this program 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 | Egg | Milk |
|---|---|---|---|---|
| | | (000 t) | (000 t) | (000 t) |
| 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% of the total agricultural development budget to livestock in the second Five year Development Plan and 6.4% 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% or 2% 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% of Indonesia's smallholders, accounting for 60% 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% 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% above the number in 1983. Provinces where relatively large increases occurred were Lampung (the province on Sumatera located closest to the heavily populated province of West Java and Jakarta), Maluka (between Irian Jaya and Sulawesi) and Timor-Timur (Table 9).

In general the farm households involved in livestock production practice 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 eggs[1]. Livestock are also used for ritual and ceremonial occasions, and recreation[2]. Larger livestock – cattle and buffalo - are liquid assets that provide a hedge against inflation and can be converted to cash when the need arises[3]. 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) summarises research that has investigated the improvements that livestock can make to farmer's income 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" (p188).

**Table 9 Number of households engaged in animal husbandry by province**

| Province | Urban | | Rural | | Total | | Ratio of |
|---|---|---|---|---|---|---|---|
| | 1983 | 1993 | 1983 | 1993 | 1983 | 1993 | 1993/1983 |
| | (000) | (000) | (000) | (000) | (000) | (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 |
| Bengkuku | 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% of households in the livestock industries in 1993 had six or more family members, while 25.5% had fewer than four household members. The most likely age category for the farmer was 40 to 59 years, and few (10%) had been educated beyond primary school (Table 10). For those with another source of income, in 78.1% 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, Riethmuller, Sayaka, Smith and Yusdja 1996).

**Table 10 Characteristics of Indonesian livestock producers, 1993**

| Item | Number | Percentage |
|---|---|---|
| *Household size* | | |
| < 4 | 1377817 | 25.5 |
| 4 – 5 | 2401156 | 44.5 |
| 6 – 7 | 1224886 | 22.7 |
| > 7 | 390409 | 7.2 |
| Total | 5394268 | 100.0 |
| *Age* | | |
| < 20 years | 18114 | 0.3 |
| 20 –39 | 1740276 | 32.3 |
| 40 – 59 | 2814542 | 52.2 |
| > 59 | 821336 | 15.2 |
| Total | 5394268 | 100.0 |
| *Education* | | |
| no education | 1149056 | 21.3 |
| not completed primary school | 1833111 | 34.0 |
| primary school | 1874353 | 34.7 |
| junior high | 305691 | 5.7 |
| senior high | 210038 | 3.9 |
| university | 22019 | 0.4 |
| Total | 5394268 | 100.0 |

Source: Direktorat Jenderal Peternakan

**Table 11 Main income source of Indonesian farmers, 1993**

| Source | Number | Percentage |
|---|---|---|
| Other agriculture | 4215204 | 78.1 |
| Mining and quarrying | 54275 | 1.0 |
| Industry/handicraft | 87786 | 1.6 |
| Trade | 254098 | 4.7 |
| Transport | 78987 | 1.5 |
| Services | 334288 | 6.2 |
| Income earner | 110697 | 2.1 |
| Other | 228406 | 4.2 |
| No other | 30527 | 0.6 |
| Total | 5394268 | 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 draft power, manure and add value to crop residues. They also make use of seasonal

labour surpluses, or underemployed family labour[4]. The contribution to farmer welfare of livestock varies regionally and with farm wealth. Oka, Widowati, Lubis and Holden (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" (p56).

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% compared to 5.2% for indigenous chickens and 4.4% for ducks. Policy makers see the broiler industry as an important source of animal protein since in comparison with cattle poultry are efficient converters of feed grains into meat.

[4] According to Kasryno 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%.

**Table 12 Poultry numbers in Indonesia, 1969 to 1997**

| Year | Indigenous chickens | Poultry | | |
|---|---|---|---|---|
| | | Layers | Broilers | Duck |
| | (000) | (000) | (000) | (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 | 245 68 | 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: Direktor 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% 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% 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 animal 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.

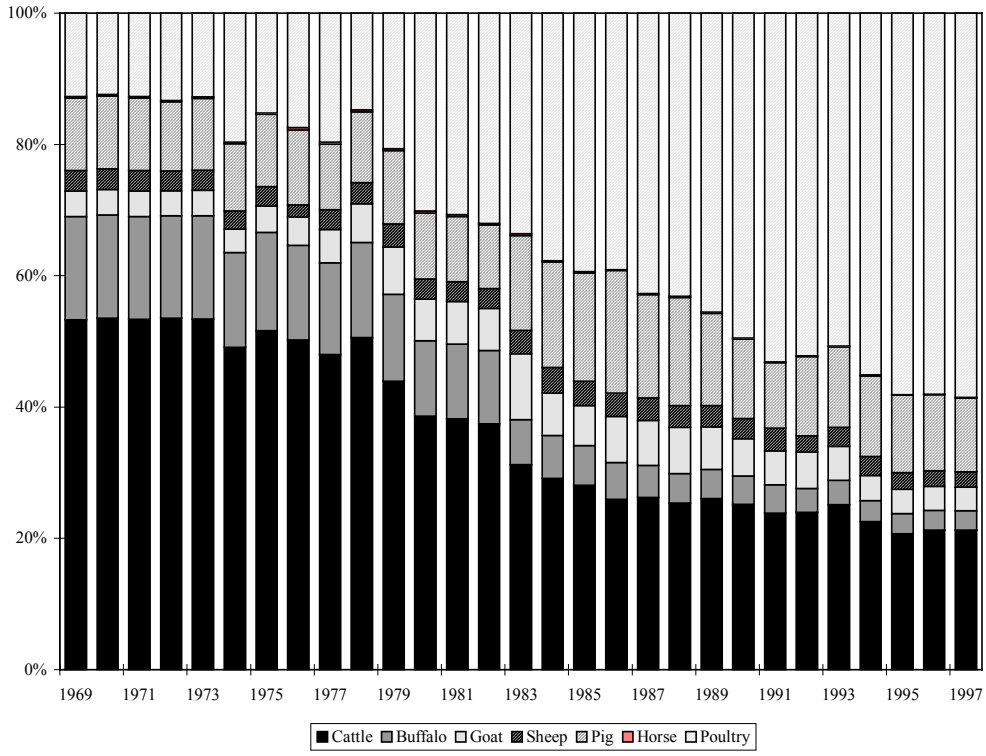


**Figure 7 Consumption of meats by species, 1969 to 1997**

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.

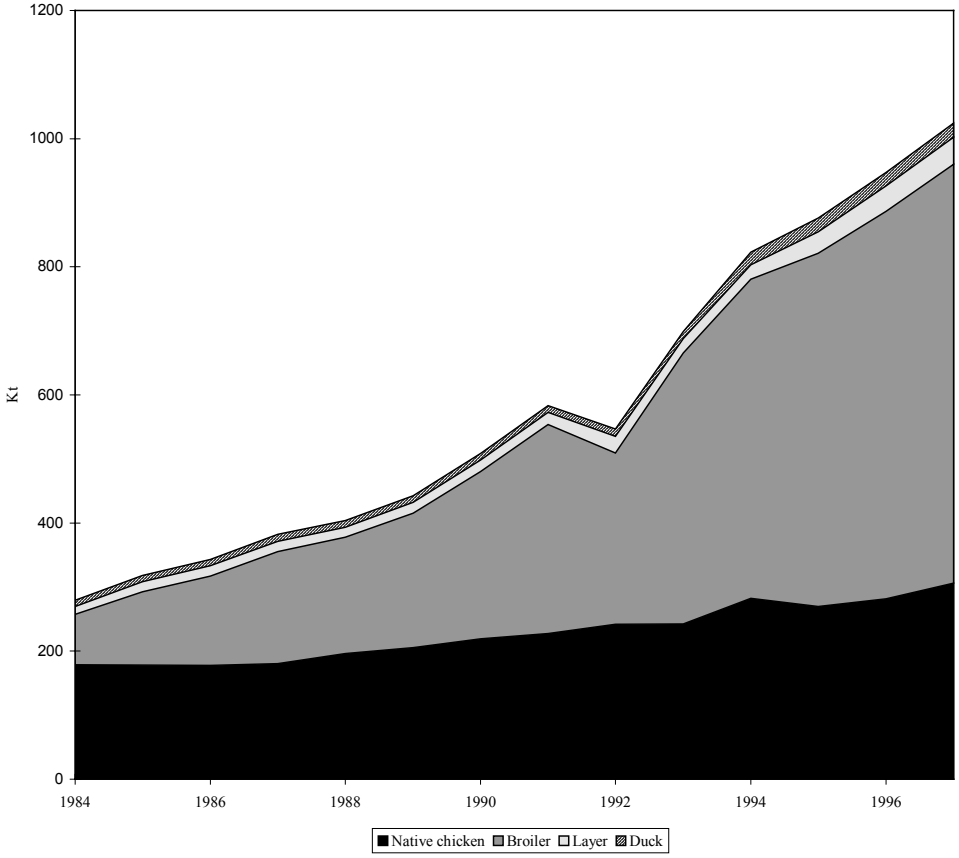


**Figure 8 Consumption of poultry meat, 1984 to 1997**

## NATIVE CHICKEN

As indicated in the previous section and in Chapter 1 of this report native chicken - or indigenous chicken - are an important part of the poultry industry. They require almost no inputs and help to maintain hygiene in rural villages through 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 chicken 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 chicken had about 480 birds in 1993 as compared to around six in the earlier year. Native chickens are reared throughout Indonesia, with the highest numbers being found in Java.

**Table 13 Number of native chicken household 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 |
| Bengkuku | 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% 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 to1997 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 | 7280 | 9645 | 10079 | 10285 | 12134 | 12705 | 13643 | 15107 | 15711 | 5.80 | 2.16 |
| Sumatera Utara | 9767 | 11237 | 12175 | 12748 | 13669 | 15585 | 17358 | 19165 | 21160 | 7.82 | 2.17 |
| Sumatera Barat | 5420 | 8171 | 8816 | 9363 | 9540 | 9525 | 9922 | 10187 | 10460 | 3.86 | 1.93 |
| Riau | 2069 | 2947 | 3107 | 2764 | 3343 | 3498 | 3734 | 3913 | 4100 | 1.51 | 1.98 |
| Jambi | 1685 | 2824 | 3092 | 3228 | 3456 | 3735 | 3917 | 4108 | 4318 | 1.59 | 2.56 |
| Sumatera Selatan | 5270 | 7237 | 7267 | 10045 | 10393 | 12110 | 12925 | 14350 | 15600 | 5.76 | 2.96 |
| Bengkuku | 2612 | 4021 | 4026 | 4043 | 4061 | 4078 | 4081 | 4163 | 4246 | 1.57 | 1.63 |
| Lampung | 4500 | 9213 | 10012 | 10720 | 11398 | 18759 | 13409 | 14068 | 14765 | 5.45 | 3.28 |
| DKI Jakarta | 242 | 702 | 702 | 252 | 222 | 153 | 114 | 128 | 127 | 0.05 | 0.52 |
| Jawa Barat | 19436 | 28278 | 28468 | 31669 | 36121 | 36702 | 35555 | 36193 | 35068 | 12.95 | 1.80 |
| Jawa Tengah | 23897 | 29454 | 29784 | 31092 | 31239 | 31479 | 33580 | 34328 | 35093 | 12.96 | 1.47 |
| DI Yogyakarta | 4039 | 4829 | 4831 | 4904 | 4978 | 5044 | 5053 | 5054 | 5100 | 1.88 | 1.26 |
| Jawa Timur | 26252 | 29511 | 30106 | 30675 | 31012 | 31105 | 33565 | 34286 | 37098 | 13.70 | 1.41 |
| Bali | 3714 | 5432 | 5380 | 5685 | 5987 | 6130 | 6313 | 6349 | 6462 | 2.39 | 1.74 |
| Nusa Tenggara Barat | 3252 | 3974 | 5713 | 4115 | 4545 | 4937 | 5286 | 5674 | 6178 | 2.28 | 1.90 |
| Nusa Tenggara Timur | 3313 | 4391 | 4527 | 6139 | 6767 | 7123 | 7614 | 7805 | 8000 | 2.95 | 2.41 |
| Timor-Timur | 409 | 514 | 551 | 581 | 613 | 498 | 526 | 555 | 585 | 0.22 | 1.43 |
| Kalimantan Barat | 2043 | 2295 | 2332 | 2717 | 3023 | 3368 | 3503 | 4673 | 4953 | 1.83 | 2.42 |
| Kalimantan Tengah | 1650 | 1629 | 1674 | 1707 | 2082 | 2305 | 2358 | 2477 | 2750 | 1.02 | 1.67 |
| Kalimantan Selatan | 4104 | 4647 | 4801 | 4437 | 4797 | 4980 | 5193 | 5356 | 5443 | 2.01 | 1.33 |
| Kalimantan Timur | 2010 | 2632 | 2374 | 3022 | 3214 | 3557 | 3738 | 4139 | 4324 | 1.60 | 2.15 |
| Sulawesi Utara | 1247 | 1510 | 1541 | 1705 | 1790 | 1880 | 1974 | 2072 | 2176 | 0.80 | 1.74 |
| Sulawesi Tengah | 1417 | 2788 | 3267 | 3832 | 4493 | 2774 | 3260 | 2504 | 2566 | 0.95 | 1.81 |
| Sulawesi Selatan | 15388 | 15911 | 16296 | 19127 | 6577 | 13359 | 14924 | 14949 | 14962 | 5.53 | 0.97 |
| Sulawesi Tenggara | 2850 | 5357 | 5500 | 4807 | 4372 | 4978 | 5528 | 5824 | 6115 | 2.26 | 2.15 |
| Maluku | 1164 | 1290 | 1329 | 1507 | 1566 | 1670 | 1743 | 1957 | 2000 | 0.74 | 1.72 |
| Irian Jaya | 603 | 928 | 1217 | 1363 | 1503 | 1229 | 1269 | 1329 | 1395 | 0.52 | 2.31 |
| Indonesia | 155629 | 201366 | 208966 | 222530 | 222893 | 243260 | 250080 | 260713 | 270756 | 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 % 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 46% of native chicken meat production. Most provinces increased their output of native chicken meat by 10% or more between 1990 and 1997.

**Table 15 Native chicken production 1990 to 1997 by province**

| Provinces | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | | 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 |
| Bengkuku | 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: Direktor Jenderal Peternakan (1997) p.110 for 1995 to 1997 data; Direktor Jenderal Peternakan (1996), p.98 for 1990 to 1994 data; Direktor Jenderal Peternakan (1988), p.32 for 1985 data

## BROILER CHICKENS

The production of meat through the broiler industry has increased dramatically in Indonesia. Up until the 1997 crisis in the economy, large intensive farms that for the most part are operated by the private sector were operating. 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% of Indonesia's broiler production. Jawa Tengah, Timur Timur and DI Yogyakarta all showed production increases of more than 500% between 1985 and 1997 (Table 16).

The farms producing broiler chickens employ modern technologies. This also involves the use of imported feed grains, imported grand parent 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% of their "normal" level. Most small farms had reportedly 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 Rp5 500 in late November 1997 to Rp11 000 per bird by March 1998. Likewise egg prices over this period increased from Rp2 650 per kg to Rp5 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% of the broiler production is consumed on Java and Bali.

## Table 16 Broiler meat production 1985 to 1997 by province

| Provinces | 1985 (Kt) | 1990 (Kt) | 1991 (Kt) | 1992 (Kt) | 1993 (Kt) | 1994 (Kt) | 1995 (Kt) | 1996 (Kt) | 1997[(a)] (Kt) | 1997[(a)] (%) | 1997/1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Bengkuku | 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 | 21.85 |
| 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 turnoff 1985 to 1995, by province**

| Provinces | 1985 (000) | 1990 (000) | 1991 (000) | 1992 (000) | 1993 (000) | 1994 (000) | 1995* (000) | 1995/1985 |
|---|---|---|---|---|---|---|---|---|
| DI Aceh | 65 | 58 | 152 | 74 | 106 | 196 | 299 | 4.63 |
| Sumatera Utara | 2049 | 3796 | 4107 | 4444 | 5012 | 6943 | 8021 | 3.91 |
| Sumatera Barat | 0 | 363 | 400 | 673 | 616 | 807 | 863 | nc |
| Riau | 439 | 2214 | 2276 | 2746 | 2210 | 1675 | 1894 | 4.32 |
| Jambi | 390 | 828 | 870 | 1056 | 986 | 1344 | 2090 | 5.36 |
| Sumatera Selatan | 302 | 1210 | 2196 | 810 | 735 | 853 | 904 | 2.99 |
| Bengkuku | 136 | 379 | 383 | 407 | 373 | 540 | 749 | 5.50 |
| Lampung | 0 | 191 | 475 | 912 | 1076 | 1330 | 1330 | nc |
| | | | | | | | | |
| DKI Jakarta | 668 | 487 | 487 | 312 | 208 | 183 | 167 | 0.25 |
| Jawa Barat | 4620 | 8587 | 11760 | 14306 | 17409 | 22086 | 29151 | 6.31 |
| Jawa Tengah | 143 | 4380 | 7001 | 8154 | 10605 | 14224 | 20704 | 144.48 |
| DI Yogyakarta | 199 | 813 | 815 | 830 | 913 | 1187 | 1416 | 7.11 |
| Jawa Timur | 1102 | 3242 | 3643 | 5321 | 7951 | 11806 | 6923 | 6.28 |
| | | | | | | | | |
| Bali | 406 | 911 | 936 | 958 | 999 | 1609 | 2109 | 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 | 1488 | 1081 | 3.64 |
| Kalimantan Tengah | 288 | 2214 | 2420 | 0 | 534 | 1654 | 1676 | 5.82 |
| Kalimantan Selatan | 0 | 692 | 701 | 845 | 568 | 865 | 937 | nc |
| Kalimantan Timur | 693 | 1385 | 1656 | 1449 | 1342 | 2511 | 2992 | 4.32 |
| | | | | | | | | |
| Sulawesi Utara | 262 | 690 | 744 | 976 | 1180 | 1579 | 1582 | 6.03 |
| Sulawesi Tengah | 0 | 1 | 1 | 5 | 7 | 159 | 160 | nc |
| Sulawesi Selatan | 0 | 189 | 213 | 2924 | 1650 | 681 | 738 | nc |
| Sulawesi Tenggara | 0 | 0 | 0 | 0 | 0 | 0 | 0 | nc |
| | | | | | | | | nc |
| Maluku | 132 | 568 | 674 | 580 | 514 | 951 | 951 | 7.22 |
| Irian Jaya | 817 | 762 | 610 | 614 | 600 | 992 | 960 | 1.18 |
| | | | | | | | | |
| Indonesia | 13018 | 326612 | 407908 | 459097 | 528159 | 622965 | 669793 | 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 turnoff 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 turnoff in the three Javanese provinces as well as DI Yogjakarta were calculated. The results in Figure 9 show the ratio of production to turnoff 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.

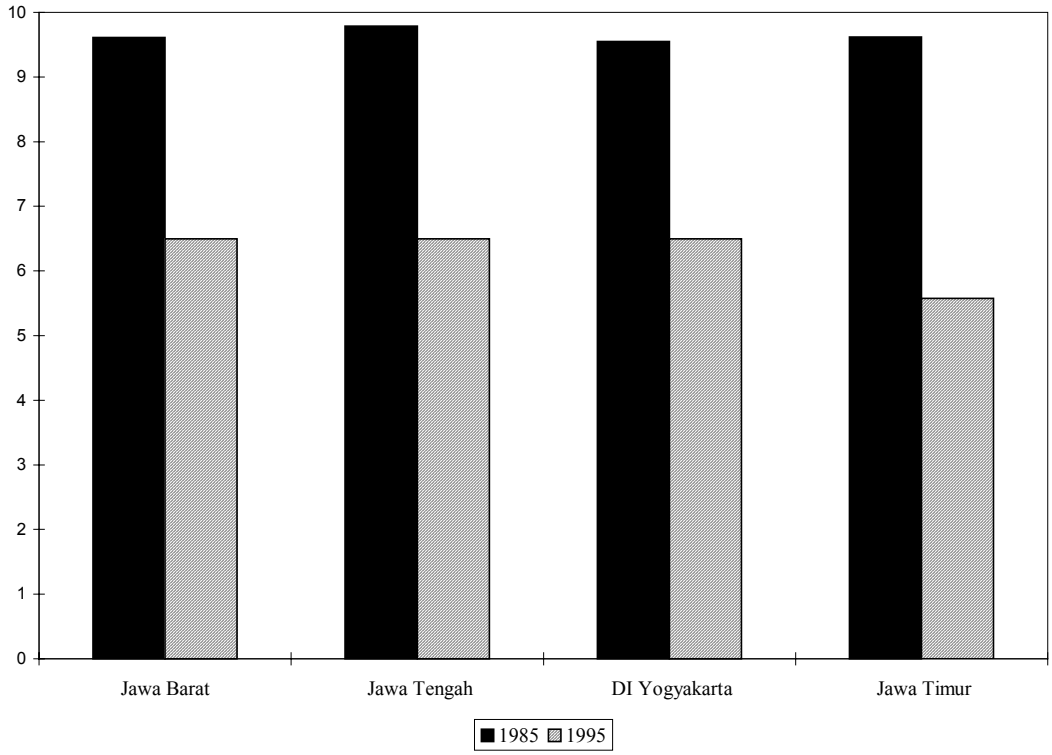


**Figure 9 The ratio of production to turnoff in the broiler industry, selected provinces, 1985 and 1995**

As well as obtaining poultry meat from native chickens and the intensive broiler industry, cull chickens from egg producing farms are also providers of poultry meat. 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 | | 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 |
| Bengkuku | 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: Direktor Jenderal Peternakan (1997), p.111 for 1995 to 1997 data; Direktor 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 more than fifteen times between 1969 and 1997. This represents an annual average growth rate of about 9.9%. 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%. 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% and 5.5%, 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: Direktor Jenderal Peternakan (1997), p.114 for 1995 to 1997 data; Direktor 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%, Jawa Barat 19% and Jawa Tengah 12%. Between 1985 and 1997, layer population in Indonesia as a whole increased by about 169%, with the greatest increase occurring in Lampung, Sulawesi Selatan, Nusa Tenggara Barat, Jawa Timur (East Java) and Timur 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% between 1985 and 1997 (Table 21).

**Table 20 Layer population 1985 to1997 by province**

| Province | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | | 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 | 2433 | 2413 | 2515 | 3005 | 2773 | 3985 | 4469 | 4875 | 5123 | 5.99 | 2.11 |
| Sumatera Barat | 1399 | 1568 | 1604 | 1601 | 1731 | 1620 | 1643 | 1570 | 1613 | 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 | 1186 | 752 | 799 | 806 | 984 | 1060 | 1200 | 1.40 | 2.30 |
| Bengkuku | 2612 | 37 | 39 | 37 | 37 | 38 | 38 | 55 | 80 | 0.09 | 0.03 |
| Lampung | 567 | 888 | 1127 | 1831 | 2034 | 2193 | 2394 | 3415 | 3958 | 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 | 8538 | 8401 | 8587 | 12069 | 12166 | 13655 | 13287 | 15280 | 16275 | 19.04 | 1.91 |
| Jawa Tengah | 4064 | 4402 | 4795 | 4939 | 4926 | 6865 | 8068 | 9126 | 10324 | 12.08 | 2.54 |
| DI Yogyakarta | 1730 | 1953 | 1953 | 1892 | 1997 | 2336 | 2403 | 2219 | 2300 | 2.69 | 1.33 |
| Jawa Timur | 6092 | 9923 | 11247 | 13147 | 12593 | 13610 | 15910 | 18540 | 19665 | 23.01 | 3.23 |
| Bali | 961 | 1124 | 1305 | 1318 | 1355 | 1477 | 1634 | 1727 | 1848 | 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 | 1171 | 536 | 648 | 1029 | 1177 | 1562 | 1806 | 2115 | 2289 | 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 | 1703 | 1919 | 2215 | 1853 | 2816 | 2823 | 3413 | 4127 | 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 | 31785 | 43185 | 46885 | 54146 | 54736 | 63335 | 68897 | 78706 | 85471 | 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 | | 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 |
| Bengkuku | 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: Direktor Jenderal Peternakan (1997), p117 for 1994 to 1997 data, Direktor Jenderal Peternakan (1996), p.104 for 1990 to 1994 data; Direktor 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 since 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 |
| Bengkuku | 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 different times, representatives of the small producers have requested the government to require large producers export 65% of their

output instead of selling domestically. Since May 1990, foreign poultry producers have been required to export 65% 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 2500 head. Broiler: turns off more than 19500 head per year. Provinces with no large poultry farms are omitted from the table. [b] Govt indicates government
Source: CASER (pers.com)

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 |
| Bengkuku | 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 23, 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% higher in 1997 than in 1985.

**Table 25 Duck population 1985 to1997, 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 | 2788 | 2436 | 2534 | 2682 | 2709 | 2803 | 3137 | 3226 | 3412 | 10.94 | 1.22 |
| Sumatera Utara | 1343 | 1202 | 1266 | 1391 | 1721 | 2009 | 2155 | 2155 | 2365 | 7.59 | 1.76 |
| Sumatera Barat | 1261 | 1558 | 1626 | 1692 | 1703 | 1504 | 1659 | 1659 | 1659 | 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 | 1113 | 1180 | 1430 | 1502 | 1524 | 1473 | 1511 | 1600 | 5.13 | 1.93 |
| Bengkuku | 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 | 2598 | 3019 | 3068 | 3407 | 3886 | 3703 | 3888 | 3904 | 3925 | 12.59 | 1.51 |
| Jawa Tengah | 2792 | 3090 | 3184 | 3425 | 3521 | 3575 | 3756 | 3768 | 3781 | 12.13 | 1.35 |
| DI Yogyakarta | 236 | 249 | 249 | 218 | 219 | 227 | 232 | 232 | 233 | 0.75 | 0.99 |
| Jawa Timur | 2118 | 2020 | 2140 | 2140 | 2152 | 2421 | 3166 | 2868 | 2986 | 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 | 2214 | 2420 | 0 | 534 | 183 | 210 | 206 | 202 | 0.65 | 0.92 |
| Kalimantan Selatan | 2105 | 692 | 701 | 845 | 568 | 2652 | 2694 | 3116 | 3334 | 10.70 | 1.58 |
| Kalimantan Timur | 250 | 1385 | 1656 | 1449 | 1342 | 243 | 268 | 316 | 320 | 1.03 | 1.28 |
| Sulawesi Utara | 246 | 690 | 744 | 976 | 1180 | 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 | 3777 | 189 | 213 | 2924 | 1650 | 2244 | 2297 | 2299 | 2322 | 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 | 23871 | 326612 | 407908 | 459097 | 528159 | 27536 | 29616 | 29959 | 31177 | 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

draft 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 Bengkuku had no beef cattle raising households in 1963, but by 1993, Lampung had 125 000 and Bengkuku 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 per cent 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 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 program (INSAPP) in 1997-98. The objective of this program was to increase the beef cattle population by natural increase of 318 340. Under the program, semen from pure breed bulls was to be distributed to farmers. The program was to be extended to other provinces in following years. At the time of writing, it was not clear whether the program was to be shelved.

**Table 26 Number of beef cattle household 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 |
| Bengkuku | 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 (000) | 1990 (000) | 1991 (000) | 1992 (000) | 1993 (000) | 1994 (000) | 1995 (000) | 1996 (000) | 1997[(a)] (000) | 1997[(a)] (%) | 1997/1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DI Acch | 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 |
| Bengkuku | 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 | 1083 | 1162 | 1191 | 1184 | 1193 | 1249 | 1253 | 1260 | 1267 | 10.43 | 1.17 |
| DI Yogyakarta | 184 | 190 | 190 | 191 | 191 | 193 | 196 | 197 | 197 | 1.62 | 1.07 |
| Jawa Timur | 2791 | 3005 | 3062 | 3157 | 3163 | 3328 | 3302 | 3339 | 3383 | 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 | 1176 | 1218 | 1226 | 1236 | 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 | 9111 | 10410 | 10667 | 11211 | 10929 | 11368 | 11534 | 11816 | 12149 | 100 | 1.33 |

Notes: [(a)] Preliminary figures
Source: Direktorat Jenderal Peternakan (1997), p89 for 1990 to 1997 data; Direktorat Jenderal Peternakan (1988), p3 for 1985 data.

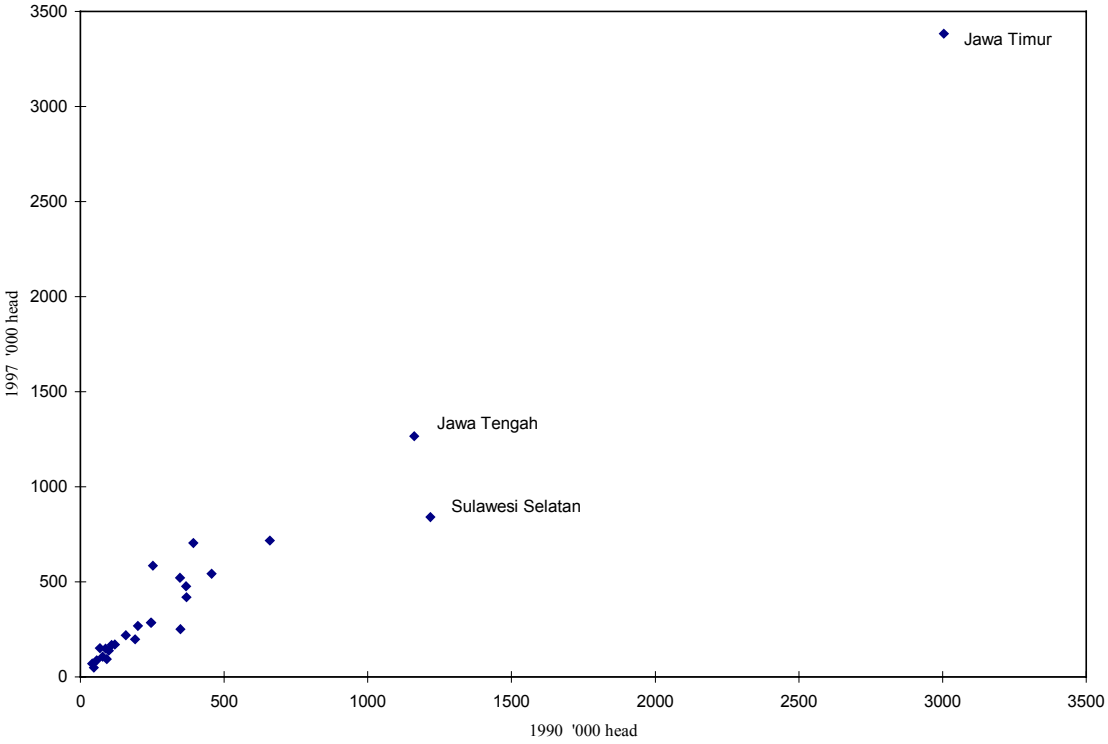


**Figure 10 Beef cattle numbers in 1990 and 1997 in each of Indonesia's provinces**

Despite an increase in cattle numbers of around 27%, Indonesia managed to increase production of beef by just under 50% 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. Specialised beef producers supplying the Jakarta market also use a Fresian 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% higher. On the other hand, cattle numbers in Jawa Barat increased by about 31% and production increased by over double this - by 64%. The situation in Jawa Tengah was similar. Cattle numbers increased by about 16% and production by 39%. 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 | | 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 |
| Bengkuku | 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 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 draft/beef. These are Ongole, Bali and Madura. The less well know breed- the Aceh - is found in the Aceh province. Swamp buffalo are also used for draft 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 since more up-to-date data were unavailable.

**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% between 1963 and 1993. The falls were not uniform across Indonesia. On Java island, the number of households with buffalo in each of the provinces fell by between 79% (Jawa Tengah and DI Yogyakarta) and 65% (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% higher than in 1963 while in each of the four provinces on Kalimantan the number of households with buffalo showed increases of between 97% and 660%. For most of the households with buffalo, the main use of the buffalo would be as a draft 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 |
| Bengkuku | 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 | | 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 |
| Bengkuku | 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 | 3245 | 3335 | 3311 | 3342 | 3057 | 3104 | 3136 | 3171 | 3238 | 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 to1994 by province**

| Province | 1985 (Kt) | 1990 (Kt) | 1991 (Kt) | 1992 (Kt) | 1993 (Kt) | 1994 (Kt) | 1995 (Kt) | 1996 (Kt) | 1997[(a)] (Kt) | 1997[(a)] (%) | 1997/1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Bengkuku | 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 | 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 cooperatives have been an important part of the industry since the industry is based upon smallholders organized into cooperatives. The first cooperative was established in Pengalengan,

near Bandung in West Java in 1948. Later, cooperatives 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 cooperatives went bankrupt, so that by 1978, only two cooperatives had managed to survive. These were Pengalengan[5] 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 cooperative organization - known as BKKSI (the Indonesian Dairy Cooperative Board) was established in July 1978. This body lasted only one year, being replaced by the GKSI (Union of Dairy Cooperatives of Indonesia, or Gabungan Koperasi Susu Indonesia). This is a secondary cooperative, whose membership is made up of the Chairman of the primary (or farmer level) cooperatives (GKSI 1996). GKSI still plays an important part in the industry since 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% of the households with dairy cattle were on Java while 3.3% 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 program 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 cooperative in Indonesia in terms of number of members. In 1996, there were about 12 000 member farmers.

**Table 33 Number of dairy cattle household 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 |
| Bengkuku | 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: 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), p51

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% 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 subsidised with government funding. It is apparent from Table 34 that almost all of 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 to1995, 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 | 6368 | 7233 | 7428 | 7625 | 7833 | 7920 | 7935 | 8362 | 8811 | 2.49 | 1.38 |
| Sumatera Barat | 1968 | 2314 | 2393 | 2331 | 1821 | 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 |
| Bengkuku | 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 | 5156 | 5811 | 5881 | 5537 | 5342 | 4796 | 4653 | 4312 | 4300 | 1.22 | 0.83 |
| Jawa Barat | 49666 | 104580 | 107087 | 108218 | 113803 | 114681 | 118753 | 119744 | 121262 | 34.33 | 2.44 |
| Jawa Tengah | 41251 | 75279 | 78844 | 81647 | 90993 | 94457 | 97035 | 97520 | 98007 | 27.75 | 2.38 |
| DI Yogyakarta | 3470 | 3761 | 2876 | 2924 | 2924 | 2766 | 2791 | 2744 | 2900 | 0.82 | 0.84 |
| Jawa Timur | 66278 | 93769 | 100524 | 102235 | 105657 | 107216 | 108299 | 113554 | 116064 | 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 | 175638 | 293878 | 306290 | 312226 | 329520 | 334021 | 341334 | 347989 | 353199 | 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 |
| Bengkuku | 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: Notes: [a] Provinces that did 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 cooperative 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 consume the milk produced on the farm themselves. 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 l. to 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 hasn't been watered down; and the employee of the cooperative collecting the milk carries out a taste test. The price that each farmer receives is the average for the cooperative, providing farmers with little or no incentive to improve milk quality. Prices between cooperatives can vary, depending on the quality of the milk the cooperative delivers to the processing plant.

One of the initial functions of the GKSI was to arrange imports of dairy cattle[6]. 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 cooperatives and KUD. The KUD or Koperasi Peternak Serap are village based dairy cooperatives that collect milk and the sell it to the processors. Most of the imported cattle were assigned to eight provinces[7]. 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 since in some parts of Indonesia, Kristanto (1982) points out that tending animals is considered to be an inferior occupation for adult males[8]. 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 programs 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 nonproductive 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.

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[6] Imports took plpace 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 Fresian cattle imported from Denmark. Imports (also Holstein Fresians) in 1965 came from the Netherlands.

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

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

The dairy cattle population is made up almost exclusively of pure bred Fresian 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 Fresian Holsteins may be a source of inefficiency for the industry. On the positive side, a beef fattening industry has developed among small holders using the Fresian Holstein bull calves produced from dairy cows. These cattle have shown a hardiness and rapid rate of growth under typical small holder 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 Fresian 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) program based mainly upon Fresian 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 Fresian 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 Fresian 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 programs 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 for 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 is unknown and ten years later this still seemed 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 Fresian 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%.

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 two litres 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 in the industry to encourage the local industry[9]. 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%. According to INI ANSREDEF (1995), Indonesia was planning to continue with the mixing arrangements in the short term, replacing it by a tariff in 2003 as part of Indonesia's commitment to the WTO[10]. 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 import[11]. Information on the price at which BUSEP have been traded is not made public. Riethmuller and Smith (1994) and then Riethmuller *et al.* (1999) estimated the welfare losses from the policy to be of the order (at most) of A$25 million to $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.

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

Dairy consumption 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 since refrigeration is not common in Indonesia. Powdered milk ids 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 production information and information on farm numbers that follow. 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% of the income earned by smallholders near to rubber plantations[12]. 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 household 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 |
| Bengkuku | 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 figure
Source: Direktorat Jenderal Peternakan (1996), p53.

Goat numbers in Indonesia increased by 39% 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 to1997 by province**

| Provinces | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | | 1997/1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (000) | (000) | (000) | (000) | (000) | (000) | (000) | (000) | (000) | (%) | |
| DI Aceh | 336 | 389 | 403 | 475 | 484 | 557 | 577.633 | 609 | 670 | 4.61 | 1.99 |
| Sumatera Utara | 306 | 466 | 490 | 515 | 541 | 586 | 648.832 | 714 | 785 | 5.40 | 2.57 |
| Sumatera Barat | 203 | 230 | 235 | 240 | 304 | 243 | 260.639 | 280 | 303 | 2.08 | 1.49 |
| Riau | 129 | 167 | 175 | 170 | 179 | 191 | 199.777 | 224 | 252 | 1.73 | 1.95 |
| Jambi | 57 | 86 | 93 | 98 | 101 | 112 | 115.429 | 119 | 123 | 0.84 | 2.15 |
| Sumatera Selatan | 401 | 471 | 500 | 508 | 528 | 545 | 548.659 | 523 | 541 | 3.72 | 1.35 |
| Bengkuku | 123 | 144 | 145 | 148 | 150 | 151 | 154.333 | 156 | 157 | 1.08 | 1.27 |
| Lampung | 198 | 303 | 312 | 317 | 329 | 737 | 721.682 | 734 | 747 | 5.14 | 3.77 |
| DKI Jakarta | 8 | 8 | 8 | 7 | 7 | 9 | 7.291 | 8 | 8 | 0.05 | 0.98 |
| Jawa Barat | 1160 | 1787 | 1819 | 1863 | 1902 | 1914 | 1956.562 | 2099 | 2112 | 14.52 | 1.82 |
| Jawa Tengah | 2486 | 2495 | 2467 | 2646 | 2562 | 2720 | 2830.833 | 2989 | 3156 | 21.70 | 1.27 |
| DI Yogyakarta | 257 | 270 | 270 | 274 | 274 | 274 | 275.942 | 277 | 278 | 1.91 | 1.08 |
| Jawa Timur | 1995 | 2109 | 2132 | 2245 | 1647 | 2266 | 2303.542 | 2549 | 2619 | 18.01 | 1.31 |
| Bali | 72 | 95 | 100 | 107 | 113 | 117 | 116.179 | 117 | 119 | 0.82 | 1.66 |
| Nusa Tenggara Barat | 256 | 271 | 286 | 252 | 267 | 287 | 301.15 | 322 | 348 | 2.39 | 1.36 |
| Nusa Tenggara Timur | 341 | 447 | 434 | 529 | 544 | 600 | 612.229 | 505 | 629 | 4.33 | 1.84 |
| Timor-Timur | 74 | 97 | 100 | 117 | 126 | 159 | 172.225 | 187 | 203 | 1.40 | 2.74 |
| Kalimantan Barat | 48 | 50 | 50 | 61 | 64 | 84 | 87.814 | 104 | 108 | 0.75 | 2.26 |
| Kalimantan Tengah | 19 | 14 | 16 | 20 | 17 | 20 | 22.026 | 23 | 23 | 0.16 | 1.19 |
| Kalimantan Selatan | 57 | 57 | 58 | 58 | 59 | 65 | 69.458 | 72 | 73 | 0.50 | 1.28 |
| Kalimantan Timur | 42 | 51 | 54 | 56 | 59 | 62 | 66.687 | 82 | 85 | 0.58 | 2.02 |
| Sulawesi Utara | 70 | 92 | 95 | 95 | 102 | 99 | 100.542 | 103 | 105 | 0.72 | 1.49 |
| Sulawesi Tengah | 169 | 235 | 249 | 265 | 120 | 194 | 206.254 | 197 | 212 | 1.46 | 1.26 |
| Sulawesi Selatan | 518 | 622 | 631 | 642 | 653 | 437 | 452.959 | 461 | 469 | 3.22 | 0.91 |
| Sulawesi Tenggara | 90 | 127 | 131 | 109 | 110 | 92 | 101.077 | 112 | 120 | 0.83 | 1.33 |
| Maluku | 163 | 172 | 176 | 187 | 192 | 201 | 212.27 | 232 | 251 | 1.73 | 1.54 |
| Irian Jaya | 21 | 43 | 55 | 60 | 65 | 48 | 45.038 | 43 | 46 | 0.32 | 2.20 |
| Indonesia | 9599 | 11298 | 11484 | 12062 | 11502 | 12770 | 13167.06 | 13840 | 14540 | 100.00 | 1.51 |

Notes: [(a)] Preliminary figures

Source: Direktorat Jenderal Peternakan (pers.com.) for 1995 data; Direktorat Jenderal Peternakan (1996), p.81 for 190 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% 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% 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 to1997 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 |
| Bengkuku | 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 of the sheep. The 1995 population was a 47% 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 | | 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 |
| Bengkuku | 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 | 1999 | 3001 | 3053 | 3052 | 3162 | 3326 | 3543 | 3778 | 3810 | 47.85 | 1.91 |
| Jawa Tengah | 1296 | 1312 | 1309 | 1402 | 1382 | 1545 | 1716 | 1766 | 1818 | 22.84 | 1.40 |
| DI Yogyakarta | 74 | 75 | 75 | 76 | 73 | 77 | 77 | 78 | 78 | 0.98 | 1.05 |
| Jawa Timur | 917 | 988 | 1014 | 1046 | 1015 | 1159 | 1170 | 1401 | 1496 | 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 | 4885 | 6006 | 6108 | 6235 | 6240 | 6741 | 7168 | 7724 | 7963 | 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.com) 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 to1997, by province**

| Province | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | | 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 |
| Bengkuku | 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 to1997 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 | 1211 | 1971 | 2065 | 2165 | 2340 | 2388 | 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 |
| Bengkuku | <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 | 1047 | 1091 | 1056 | 1080 | 1073 | 1080 | 12.50 | 1.39 |
| Nusa Tenggara Barat | 16 | 21 | 32 | 23 | 23 | 24 | 23 | 24 | 26 | 0.30 | 1.64 |
| Nusa Tenggara Timur | 884 | 1162 | 1214 | 1341 | 1423 | 1406 | 1538 | 1589 | 2229 | 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 | 5700 | 7136 | 7612 | 8135 | 8704 | 8858 | 7720 | 7597 | 8638 | 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 | | 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 |
| Bengkuku | 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.

## PROGRAMS TO INCREASE LIVESTOCK NUMBERS

### Live cattle

Indonesia has had programs to import live cattle for at least the last two decades. For much of the period 1980 to 1990, breeding cattle were imported as draft cattle and as breeding cattle for the transmigration program[13]. 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 Indonesia economy, live cattle imports will resume.

The idea of the breeder cattle program is that the farmer will be able to increase cattle numbers through breeding from a female. Most of the animals imported for the breeder program 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 draft animal during the period when it is used for draft purposes may not understand the need to provide supplementary feed to maintain the animal's condition at other times.

Up 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% while beef has a tariff of 20% (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 program is a key part of the government's agricultural development program. It is seen as a way of reducing population pressure in Java, Madura, Lamoung, Lombok and Bali by resettling landless and land poor families in the sparsely populated outer islands.

**Box 1 Specification for live cattle imports**

**Tariffs**

- slaughter cattle 15%

Import permits

- required for all cattle types

**Specifications**

- feeder cattle - preferred minimum 50% *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 program 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%) and West Java (33%).

**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 Ultama | 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 Plasma 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 getpaid on the weight of the animal. In late 1997, farmers

made about Rp50 for each kilogram of liveweight gain. Producers are discouraged from marketing the animals through the wet market.

### Credit programs

Kristanto (1982) reviews a number of programs that have been used in Indonesia. Two of these - introduced in the 1970s - will be outlined here.

- The Credit Program 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% 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 program was canceled after two years because of lack of smallholder involvement. The program 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 draft power. Also, farmers were uncertain about their ability to repay the loan because of the small market for fattened cattle.
- The Credit Program 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 program has been successful since 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 (Kasryno and Suryana 1992). Encouraging more private sector involvement and encouraging more non oil exports have been major objectives. As Kasryno and Suryana point out, agriculture has been directly affected by the reforms which have seen the substitution of a more systematic set of policy instruments 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% 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) report that while much of Indonesia's agricultural trade has been heavily regulated, agriculture has - until recently - been largely isolated from the trade reform programs that began in 1985[14]. The reform program 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% of domestic production in 1986. The 1991 trade policy reforms, which focused on agriculture, reduced to 30% 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 program began in 178) 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[15] to shadow exchange rate ratio assembled by Gunawan (1995). The estimates of the ratio of DRC to SER 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 technologies[16]; and weak cooperation between different levels of agribusiness.

[14]The major policy instruments consisted of tariffs import licencing, 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 Sumatera | 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[©] | | 0.46 | 0.41 | 0.46 | 0.31 |
| Sugar | 1.73[(d)] | 1.80[(e)] | | | |

Notes: [(a)] Under import substitution assumption (Kasryno and Simatupang,1990); [(b)] Under export promotion assumption (Kasryno and Simatupang, 1990); [©] Under export promotion assumption (Kasryno and Simatupang, 1990); [(d)] For Java
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 utilized. 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, exccept 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%, 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% on non-wheat cereal flour to 238% 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% each (General Agreement on Tariffs and Trade 1995). Its general obligations to liberalization are summarised by Table 47 and Box 2, while Table 48 shows the commitment Indonesia has given for livestock and feed inputs. There is some uncertainty as to the extent to which these will now be changed as announcements have been made that under the IMF program tariffs will be reduced on many products to 0% or 5%.

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

| Item | No. | Per cent | US$ mill. | Per cent |
|---|---|---|---|---|
| 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

- Tariffication and binding, or ceiling binding for all agricultural items
- Duty reduction of 10% 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% were all tariffied at an initial rate of 238%, 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%. According to General Agreement on Tariffs and Trade (1995), "Indonesia has agreed to levy a lower tariff of 5 per cent on in-quota imports of dairy products"(p.26).

  Removal of non tariff barriers on bound tariff items
- 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% and 25% 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 imports[17] 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 small losses were recorded for China, Africa, Canada, Australia and Latin America. The welfare gains for Indonesia are negligible according to the findings of studies referenced 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%[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 yogurt 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.

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

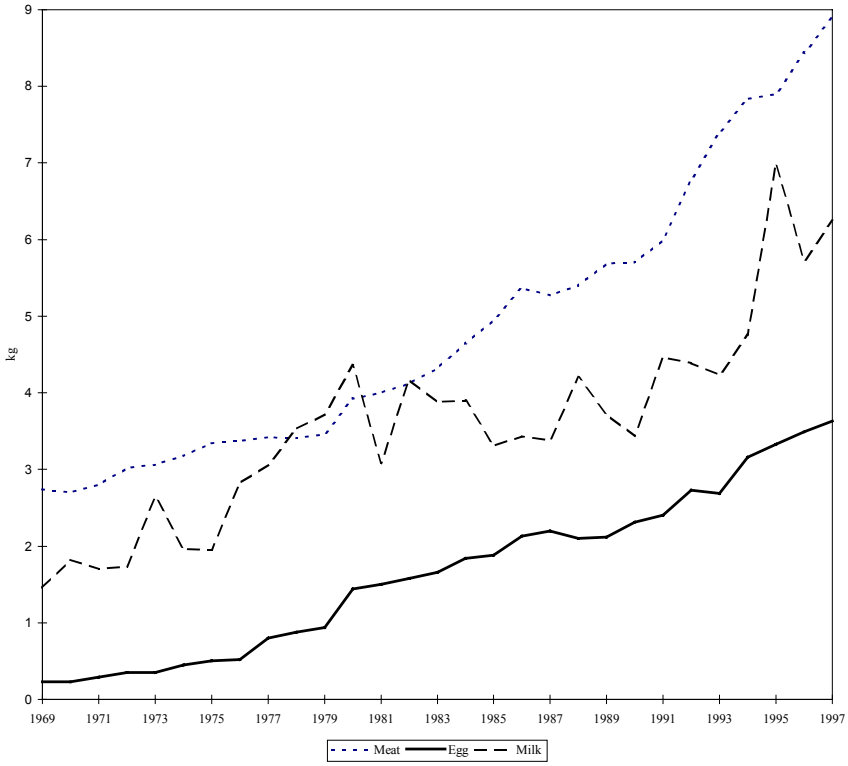


**Figure 11 Annual consumption per person of meat, eggs and milk**

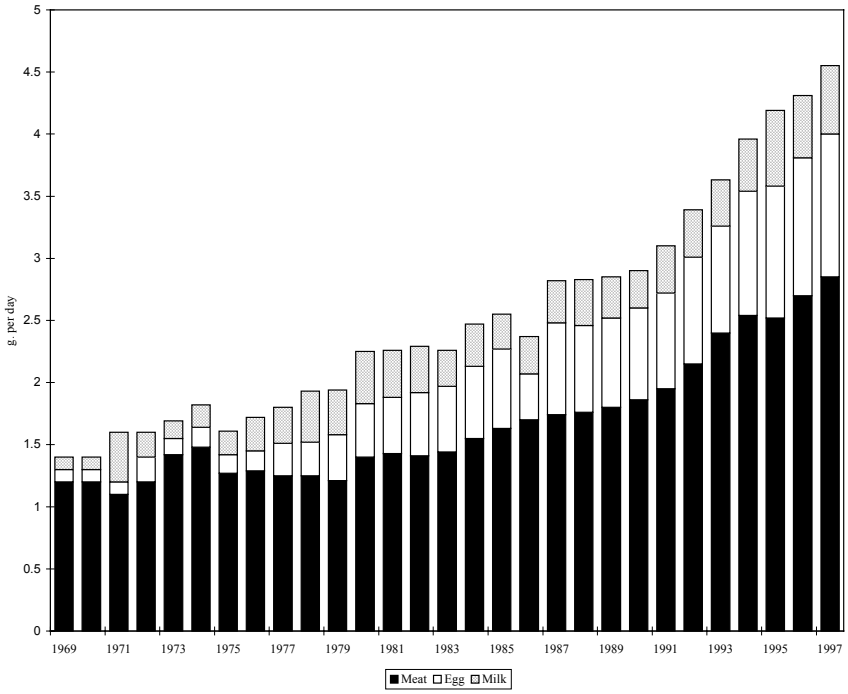


**Figure 12 Daily per person consumption of meat, eggs and milk**

**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" (p53) 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 per person income of less than Rp 25 000; group II had an income range of Rp25 000 to Rp74 999; group III had a range of Rp75 000 to Rp149 999; group IV income was from Rp150 000 to Rp300 000; and group V was over Rp300 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" (p56).

**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), p66

Table 50 and Table 51 provide estimates of elasticity estimates found from the literature for other commodities.

**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), p67

**Table 51 Elasticities for Indonesia, various authors**

| Item | Value |
|---|---|
| Corn | |
| • own price elasticity | -0.261 |
| • cross price elasticity wrt cassava | 0.056 |
| • cross price elasticity wrt soybean | 0.027 |
| Cassava | |
| • own price elasticity | -0.390 |
| • cross price elasticity wrt corn | 0.040 |
| • cross price elasticity wrt soybeans | -0.029 |
| Soybean | |
| • own price elasticity | -0.779 |
| • cross price elasticity wrt corn | 0.025 |
| • cross price elasticity wrt cassava | -0.037 |
| Beef | |
| • own price elasticity | -0.515 |
| • cross price elasticity wrt poultry | 0.155 |
| Poultry | |
| • own price elasticity | -0.647 |
| • cross price elasticity wrt 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" (p196) of the metabolizable energy available, suggesting that liveweight gain could be doubled by keeping more animals to utilize 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 needed[19]. 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.

[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 seasonis so poor that it can hardly maintain life, and mature animals loose 15-25% of their body weight" (p6).

Information on production parameters is valuable gaining an understanding the management processes of farmers. Perkins and Semali (1992) set out to investigate why 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 to 0.5 hours per day in the first two quarters of the calf development, but it then rose steadily to two hours per day to reach a plateau at 24 months. This meant that for farmers with alternate employment opportunities, it is rational for them to sell cattle young - at 9 to 18 months of age.

Data collected from farmers in West Java and reported by Bazeley, Supriantna and Banga (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" (p23) 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. Table 54 data, 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 & 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 was for 1993.
Source [(a)] INI ANSREDEF (1995); Directorat Bina Program Directorat Jenderal Peternakan (1991), Buku Statistik Peternakan [Statistical Book on Livestock], p105.

## 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, p87

**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, p87 90, p84

**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% protein and less than 18% crude fibre or less than 35% cell wall
- Protein foods include products that contain 20% or more of protein. These can be of plant or animal origin.
- Roughage are usually all products of crop residue, and contain more than 18% crude fibre or more than 35% cell wall.

Table 56 lists the estimated production and crude protein and energy (TDN) 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 |
|---|---|---|---|
| | (000t) | (%) | (%) |
| Energy feeds | | | |
| Conventional | | | |
| • rice bran | 2,577 | 10.7 | 81.0 |
| • maize bran | 403 | 14.2 | 90.9 |
| • molasses | 343 | 1.8 | 53.0 |
| Nonconventional | | | |
| • 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 (fish meal) | 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 |
| Nonconventional | | | |
| • rice straw | 34,215 | 5.5 | 26.6 |
| • soybean straw | na | 7.7 | 50.7 |
| • sweet potato leaf | 555 | 14.6 | 72.4 |
| • bagassa | 1,717.3 | 2.0 | 49.4 |
| • sago waste | na | 1.8 | 19.5 |

Source: Lebdosoekojo and Reksohadiprodjo (1982), p81

The availability and quality of feed is a constraint to the dairy industry. INI ANSREDEF (1995) claim that 90% 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 laborer 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 season[20]. Animal needs may not be adequately met and there is sometimes insufficient water for adequate levels of farm hygiene[21].

Gunawan (1995) points 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)] | Per cent 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 50km 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 cooperative. All farmers delivering to a particularly cooperative 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 cover maize, oil cake from soybean, fish meal 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 1996-97, 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 to US$10/t. 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 small holders. Manurung (1990) pointed out that crop residue and by products used for feed represented only about 15% 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, rape seed meal |
| Animal protein | Fish meal, meat bone meal |
| General feed I | Rice bran, pollard, oil cake coconut, sesbana 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 |
|---|---|---|
| DI Aceh | 1 | 33 600 |
| Northern Sumatera | 6 | 454 300 |
| Riau | 2 | 98 400 |
| Jambi | 1 | 15 000 |
| Southern Sumatera | 4 | 152 880 |
| Bengkuku | 1 | 90 000 |
| Lampung | 20 | 1 216 580 |
| **Sumatera** | **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, p13). The capacity of the company is around 470 000 t. per year. Table 60 lists the major firms and their location.

**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% to cater for growth in the poultry industry. In 1993 production was about 2.8 Mt., or about 57.9% 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%.

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 |
|---|---|
| | (m.t./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 1 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 m.t. 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) |
| DIAceh | 2 | 9 360 |
| Northern Sumatera | 29 | 64 6 386 |
| Western Sumatera | 1 | 220 |
| Riau | 3 | 24 920 |
| Jambi | 1 | 48 |
| South Sumatera | 3 | 11 600 |
| Bengkuku | 1 | 3 600 |
| Lampung | 7 | 194 800 |
| **Sumatera** | **47** | **890 934** |
| DKI Jakarta | 9 | 484 100 |
| West Java | 48 | 2 004 835 |
| DI Yogjakarta | 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 per cent 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%) of the feed mills are small operations, with annual capacity of less than 10 000 t/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 |
|---|---|---|
| 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% 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% was used for the poultry industry, 10% for shrimp and fish, and 2.5% 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% of total production (Table 67).

**Table 67 Major companies in the Indonesia feed industry, 1993**

| Company | Production | Share |
|---|---|---|
| | (000t.) | (%) |
| 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 |
| | Expansions | 4 | 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. |
| 1993 | New | 3 | These projects were planned for |
| | Expansions | 2 | completion in 1996 and 1997. They will add 395200 t to production capacity. Projects are divided equally between animals and shrimp. |
| 1994 | New | 5 | Cattle feed production will expand by |
| | Expansions | 11 | 487000 t. With the completion of two of the 16 plants. One poultry feed factory will expand capacity by 180000 t. Completion of all 16 facilities will increase production capacity by 3609500 t. The new and/or expanded plants will be operating by 1997. |

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% of animal feed consumption, pigs 4.6% and other livestock the balance of 9.4%.

**Table 70 Consumption of animal feeds, Indonesia**

| Year | Poultry | Four footed animals | Fisheries |
|---|---|---|---|
| | (000 t) | (000 t) | (000 t) |
| 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 | Imports | Exports | Consumption |
|---|---|---|---|---|
| | (000 t) | (000 t) | (000 t) | (000 t) |
| 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% of costs. Day old chicks represent about 25% 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% of costs, and this falls to 76% 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 | Four footed | Fisheries |
|---|---|---|---|
| | (000 t.) | (000 t.) | (000 t.) |
| 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 | Expected capacity | New capacity | Total |
|---|---|---|---|---|
| | (000 t.) | (000 t.) | (000 t.) | (000 t.) |
| 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 | Four footed animals | Fisheries |
|---|---|---|---|
| | (000) | | (000 t.) |
| 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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