

Role of Dairy Cooperative Services on Dairy Development in Indonesia

A Case Study of Daerah Istimewa Yogyakarta Province

Endang SULASTRI

Graduate Student, Graduate School for International Development and Cooperation
Hiroshima University, 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan
E-mail: endang@hiroshima-u.ac.jp

Keshav Lall MAHARJAN

Associate Professor, Graduate School for International Development and Cooperation
Hiroshima University, 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan
Email: mkeshav@hiroshima-u.ac.jp

Abstract

Various efforts had been made to promote dairy development as a major instrument for rural development in Indonesia. In general, the objectives of the policies and programs are to increase milk production, improve nutritional standards, and improve the economy of small farmers.

Dairy cooperatives have an important role on dairy development in Indonesia, such as milk collection and improving milk marketing facilities, adopting measures; credit, feed supply, veterinary aid, artificial insemination and cows insurance to promote milk production, undertaking more farmers oriented research and studies on the socio economic aspects of dairy business, expanding dairy education and extension services, and enhancing government role in integrated dairy development. The role of dairy cooperative services on dairy development is discussed in this paper with the case study of Daerah Istimewa Yogyakarta Province.

1. Introduction

A large number of people in rural Indonesia depend on agriculture for their livelihood. But the considerable development that have taken place in Indonesian agriculture have not brought many benefits to these people, and have had little impact on alleviating rural poverty. In a densely populated country such as Indonesia, the problem of rural poverty cannot possibly be resolved by redistribution of land that is in short supply. Thus, one of the viable alternatives at this stage would be to concentrate on developing efforts that would require less resource and have a short income-generating span. Dairy farming is such an alternative. It contributes in household income among landless people and small farmers by providing gainful employment opportunities. It also plays an important role as the domestic source of milk. According to Indonesia Central Bureau of Statistics (1997), total production of milk in Indonesia

remains low, and was estimated to have reached approximately 400,000 tons in 1996. Average growth of domestic milk production during the period 1993-1995 was less than 6% per year, while the growth of domestic milk consumption increased by approximately 35% per year. Hence, Indonesia has to import milk to meet the domestic needs.

Thus, the dairy farming, which can play a key role in improving the socio economic status of the large percentage of the rural people, has a good scope for development in Indonesia. Unfortunately, most of dairy farmers lack capital and proper technology to conduct the dairy farming individually. Government has introduced the cooperative system to overcome these limitations and provided various services to improve dairy farming as a whole. By joining the cooperative, farmers are able to raise funds through savings or credit activities and improve dairy farming through the services provided by the cooperatives. Hence, the main focus of this paper will be to assess the role of dairy cooperative services in dairy development in Indonesia, with a case study of Daerah Istimewa Yogyakarta (hereafter, DIY Province).



Figure 1. Map of Daerah Istimewa Yogyakarta (DIY) Province

2. Objectives and Research Method

The main objectives of the study are, 1) to grasp the situation of dairy farming and dairy cooperative in Indonesia, especially DIY Province and 2) to see the relationship of dairy cooperative and dairy farming and assess the role of dairy cooperative services on dairy development and its contribution on household income of the farmers.

The case study of dairy cooperative in DIY Province was considered for the positive analysis, undertaking research survey of cooperative that represent different regencies; Sleman Regency (mountain area), Bantul Regency (costal and sub urban area) and Yogyakarta Municipality. The number of dairy farming households in DIY Province were 1,175 and 114 farming households, about 10 %, were ran-

domly selected for the in depth study. Data were collected by interview with dairy cooperative officials and the farmers through a structured questionnaire, on site observation and participatory appraisal.

3. Development of Dairy Farming and Dairy Cooperative in Indonesia

Dairy farming was first introduced in Indonesia on the island of Java in 1905 by Dutch to fulfill their need for milk and milk product (cheese). First, they introduced dairy cows in the state farm in the mountainous areas in Central Java (Boyolali, Salatiga and Ambarawa) and then expanded to West Java (Bandung area near to Jakarta) and East Java (Nongkojajar, Malang and Batu). But the dairy farming was undertaken by the local farmers only after the independence when Holstein Friesian dairy cows were distributed to the small farmers in East Java (Pasuruan, Malang and Batu), Central Java (Semarang, Boyolali, Salatiga, Ambarawa and Solo) and West Java (Pasarminggu, Bogor, Sukabumi, Cianjur and Bandung). After some years its development in some special areas, such as Malang, Boyolali and Bandung were better than other areas and presently, these areas are the main areas of dairy farming in Indonesia.

Dairy farming is being promoted in Indonesia mainly to supply adequate quantity of milk at domestic market and enhance the per capita milk consumption, which is 128.5 gram per day, as of 1999 (Union of Indonesia Dairy Cooperative, 2000) far short of the 210 grams per head per day as the minimum requirements recommended by the Nutritional Advisory Committee. This still compares much unfavorably with the per capita daily milk consumption of 714 grams in Switzerland, 637 grams in New Zealand, 623 grams in United States and 509 grams in United Kingdom. Thus, the dairy farming has much scope in Indonesia. It is also promoted to provide viable subsidiary occupation to unemployed rural poor so as to raise their income earning capacities. But, many efforts are needed in dairy farming to enhance the milk production. Dairy cooperative is one of such efforts.

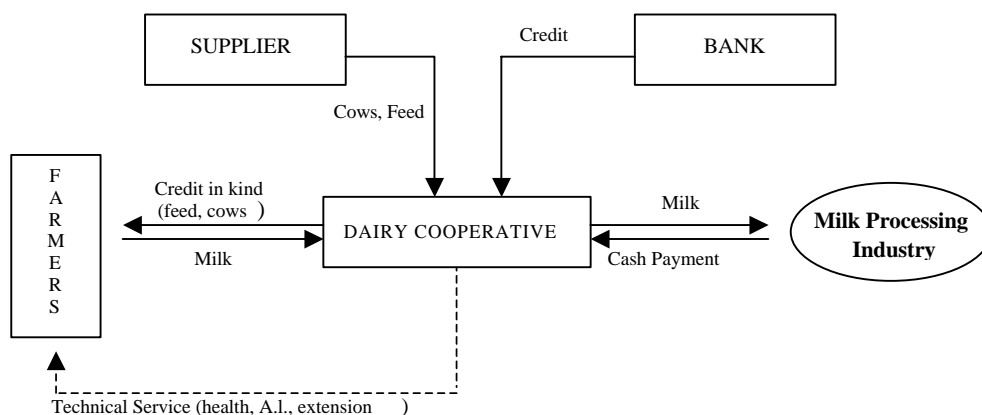
The first dairy cooperative in Indonesia was established in Pujon, Malang, East Java in 1962. Purposes of cooperative establishment were to eliminate the problems of unfair competition among the dairy farmers in pricing of milk, bad quality of cows, low milk production and low quality of milk. Before the dairy cooperative was established in 1962, the farmers were competing with each other by decreasing the milk price but mixing the milk with the water in order to get more profit. Thereafter, dairy cooperatives were established in Nongkojajar and Pasuruan in 1967, Pangalengan and Sukabumi in 1969 and Bogor in 1970, as well as in other dairy centers at Grati, Ungaran, Boyolali, Solo and Garut, all in 1978 and DIY in 1979. By 1978 there were 11 such dairy cooperatives in operation, through out Indonesia, with 2,800 cooperative members having 48,600 dairy cows. The annual milk production was 62.3 million liters. Yet the dairy farmers were faced with serious problems of selling milk as they had to compete with the uncontrolled importation of cheap milk powder, the milk price at that time was very cheap only 40 - 80 rupiahs per liter at farm gate. In spite of these efforts to develop dairy farming the cooperatives could not function well because of the activities of middlemen who collected milk and exploited the dairy farmers. The cooperatives became less active and some were forced to dissolve. Presently, there are four main dairy cooperatives in Indonesia, namely *Sinau Andadani Ekonomi* (Pujon, East Java), *Kemusuk* (Boyolali, Central Java), *Bandung Selatan* (Pangalengan, West Java) and *Warga Mulya* (DIY). These cooperatives survived the crucial years of instability of dairy farming in Indonesia during 1960s and 1970s. The main aims of the cooperatives were to provide the services related to the dairy activities i.e., milk collection, credit, extension and training to the members. During first and sec-

and Five Years Development Plan (1969-1979) artificial insemination and feed improvement program was introduced to enhance the milk production. These cooperatives at various provinces in Indonesia collaborate under the Union of Indonesia Dairy Cooperatives (hereafter, UIDC), a national organization of dairy cooperatives that formulates different services of the cooperative for dairy farming, i.e., dairy cow supply, fresh milk marketing, technical support, animal feed production, basic animal medicines, milk equipment, road tankers, milk processing and training. It was introduced in 1978 to strengthen personnel the cooperative system and upgrade the services rendered by the cooperative to the dairy farmers. The pricing of milk based on SNF and fat contains was introduced by UIDC to attain higher level of milk production and maintain milk quality. Periodically dairy cows were imported from Australia and New Zealand by Indonesia, supplied them to the farmers.

During the third Five Years Development Plan (1979-1984), Indonesia Government along with UIDC made the obligatory for the milk processing industry to buy the milk produced by the small farmers and support dairy farming. In 1981 UIDC started to give credit in the form of equipment (cooling units, milk cans, tanks and motor cycles) to the cooperative to enhance the quality of service in milk collection and encourage the dairy farmers.

Since 1982 three ministerial decrees by Minister of Industry Affairs, Minister of Agriculture and Minister of Trade and Cooperative were issued in order to increase production, processing and domestic marketing of milk. The implementing group for the above-mentioned joint decrees is the dairy technical team. This team is responsible for coordination between the milk processing industry and the Union of Indonesia Dairy Cooperatives in order to determine the milk purchasing price from the dairy farmers and to determine the ratio of absorption of such milk produced by the farmers and the volume of powdered milk which could be imported by the milk processing industry (UIDC, 2000). UIDC also started to get involved in reviewing the milk price every six months.

Dairy cooperatives aid dairy farming by providing credit in kinds of cows, feed and technical service to the dairy farmers and collect milk from them and sell it to the milk processing industry. This package program known as "Cooperative Model" was started in 1983. The credit activities of the dairy coopera-



Source: Kartadihardja, 1988

Figure 2. Cooperative Model in Dairy Development in Indonesia.

tives was supported by credit from commercial banks at the nominal interest rate of 12% to buy dairy cows and distribute to the members. The farmers repay their credit in installments deduce from their milk payments (**Figure 2**). With the effective implementation of this model, the dairy farming took roots in Indonesia. The price of the milk was also raised to 300-328 rupiahs per liter. The milk production also increased up to 227.2 million liters in 1984. However, this amount was far below the total milk consumed (622.8 million liters) the same year.

During fourth Five Years Development Plan (1984-1989), Indonesia Government made a target by the end of 1989 domestic milk production would fulfill 50% of the total milk requirement by reducing importation milk and increasing domestic milk production. In 1985 in order to reach the target, the Indonesia President made a Declaration of Presidential Decree regulated national dairy development by linking seven ministries: Ministries of Agriculture, Industry and Trade, Cooperative, Health, Home Affairs and Investment Coordination Board. Government also provided some support facilities by establishment of artificial insemination center in Lembang (West Java) and Singosari (East Java), disease investigation center in DIY Province and dairy training center in Batu (East Java) and Baturaden (Central Java). The target could not be met and Indonesia produced only 292.8 million liters but the domestic milk requirement was 761 million liters in 1989.

During fifth Five Years Development Plan (1989-1994), target to increase domestic milk production to fulfill 50% of the need for domestic milk consumption was still the issue of dairy development in Indonesia. This target also could not be also met in 1994, the domestic milk consumption was 862.1 million liter, whereas domestic milk production was only 361.7 million liters and still imported 602.8 million liters equivalent milk powder.

During sixth Five Years Development Plan (1994-1999) also target to produce 50% of milk domestic need was an issue. Even though in 1999 there were 80,931 dairy farmers, 324,719 dairy cows and the domestic milk production increased up to 378.9 million liters, Indonesia imported 509.5 million liters equivalent milk powder in order to fulfill the national consumption of 966.7 million liters.

Thus, it can be said dairy farming took off during early 80's is going through transformation period during late 80's and 90's.

4. Development of Dairy Farming and Dairy Cooperative in DIY Province

DIY Province lies on the altitude between 100 m - 499 m above sea level, has tropical climate with an average rainfall of 0.6 mm - 457.3 mm per month, influenced by the dry and the rainy seasons. Dairy farming management requires a lot of water¹. Water availability constitutes an asset to develop the dairy farming in DIY Province.

According to the Meteorology Station of Adisucipto the average temperature in DIY Province during 1999 was 26.1°C, the maximum temperature was 33.1°C and the minimum temperature was 21.6°C. The humidity was recorded 22% - 98%.

According to Etgen and Reaves (1987), dairy cows performance can be adversely affected by climatologically factors, especially by extremes in temperature and excessive humidity at high temperatures. Fortunately, cows adapt well to a wide range temperature. Although the ideal environment appears to be 30° - 60°F, or from -1° to 15°C, little adverse effect on production is noted within a range between 5° to 80°F or from -15° to +27°C. Breed differences in heat tolerance have been reported, with Holsteins having the lowest (80.6°F or 27°C) and Jerseys the highest (86°F or 30°C) in critical temperature. The

Holsteins and Jerseys could tolerate the average temperature in DIY Province.

Dairy farming in DIY Province was also introduced before independence Indonesia in 1945. First, dairy cows were introduced in Yogyakarta Municipality in 1930s. Then after independence, in 1940s dairy cows were introduced in Bantul Regency. In accordance with the Indonesian Government to promote the dairy cooperatives throughout Indonesia to enhance dairy farming, Warga Mulya Dairy Cooperative was established in DIY Province in 1979. Warga Mulya Dairy Cooperative started with 35 members in Bantul Regency and Yogyakarta Municipality of the province and provided the services of milk collection, credit and extension and training to its members in line with the policies formulated by UIDC. It also received credit of BRI in the form of 100 dairy cows at 12% interest rate. These dairy cows were loaned to the farmers at 16% interest rate. Similarly, it also received 200 dairy cows loaned from BRI in 1980, which were passed to the farmers in Yogyakarta Municipality and Bantul Regency. In order to expand the area of this cooperative, government also promoted dairy farming in Sleman Regency in early 1981 by giving 150 credit dairy cows to the farmers. The farmers who received the credit simultaneously became cooperative members. Sleman Regency has a big potential for the dairy farming, as there are plenty of upland forest needed for fodder of the dairy cows. The local government of DIY Province also gives an emphasis on dairy development in Sleman Regency. The dairy farming in DIY Province developed steadily thereafter in line with cooperative model. In 1981, first government gave the subsidy worth 450,000 rupiahs and UIDC credited the equipment of 5 cooling units, 100 milk can and 4 motorcycles to the cooperative. In 1982-1984 it received loan in the form of 1,037 dairy cows so the number of dairy farmers in DIY Province increased up to 682 in 1982, 841 in 1983, 983 in 1984 and 1002 in 1985. In order to maintain dairy cow from disease and increase the milk production, government established disease investigation center and the cooperative started to provide the veterinary aid service to the members in 1985. Dairy farming in DIY Province saw a step growth with Warga Mulya Dairy Cooperative and its services during the period of 1979-1985. This is the first phase of dairy farming in DIY Province and can be understood as early development period. **Figure 3** shows the development of dairy farming in DIY Province during 1979 and 2000 in terms of dairy cows, dairy farmers (cooperative members) and milk production.

In 1986 there were 560 dairy farmers in DIY Province and they raised 1,583 dairy cows. Animal Husbandry Service gave 100 doses of semen to Warga Mulya Dairy Cooperative free of charge and farmers of DIY Province benefited by this semen. The annual milk production was about 2,3 million liters. In 1987 the number of dairy farmers, dairy cows and milk production decreased but in 1988 the number of dairy cows increased because the cooperative got credit of 339 million rupiahs from private bank to buy dairy cow and credited to the farmers.

In 1989, dairy cows number increased by about 30% as the government, through BRI, gave the credit to farmers in the form of 250 dairy cows in Sleman Regency. Dairy farmers also increased in this year from 518 to 788. But the milk production decreased because BRI credited the heifers. In this year the cooperative also established calf raising unit to produce better stock and free farm of the burden. Thus the farmers could concentrate on milk production only. Sari Husada Milk Processing Industry contributed 68 million rupiahs in this unit and became an active partner in dairy development in DIY Province. It was moved to Sleman Regency as the regency became more up dairy pocket area in the province. In 1992, BRI through the cooperative took back dairy cows from the farmers, which it credited in 1989 because the farmers never paid the reimbursement of credit. The farmers thought that the dairy cows were given to them free of charge and need not pay the reimbursement to the BRI. It was an

unfortunate incidence in dairy farming in DIY Province due to communication gap among the farmers and cooperative personnel.

Government gave 75 million rupiahs grant to calf raising unit through Agriculture Department to strengthen the dairy farming. Consequently number of dairy cows, dairy farmers and milk production grew again. But in 1995 and 1996 the number of dairy farmers decreased because some dairy farmers in Yogyakarta Municipality had difficulties to improve their enterprises primarily because of lack of land. Also the family labors that were involved in dairy farming were very limited. They preferred to work in non agriculture activities that were available rather easily in the municipality. Thus, many of the dairy farmers in Yogyakarta Municipality left dairy farming. This trend continued until 1998. However, dairy cows and milk production was again increasing slowly even during this period. During this period of 1988-1998, dairy farming in DIY Province experienced various ups and downs. After passing through early development period the dairy cooperative also experienced difficult challenges and had setbacks, as well. But by and large government was supporting dairy cooperative and dairy farming in DIY Province. This is the second phase of dairy development in the province and can be regarded as the transformation period.

In 1997, cooperative made linkage in its services to the farmers. It collected milk from the farmers and instead of paying the farmers in cash for their milk, supplied feed and other maintenance services at the door level. This service proved very good for rural farmers, especially farmers in Sleman Regency and became a good motive for the farmers there. In 1999, the number of dairy farmers, dairy cow and milk production increased because the cooperative received credit of 485 million rupiahs from PT. Bogasari which it was used for buying dairy cows worth 350 million rupiahs and credited to the farmers, mostly in Sleman Regency. The rest was used for buying equipment of milk pasteurization. Cooperative also established the cows feed unit to fulfill the need of concentrate demanded by the farmers to maintain the milk production. Thus, once again dairy farming was showing a growth after the decade of transformation period. The performance of Warga Mulya Dairy Cooperative was so good that it was the best cooperative in among all kind of cooperatives in DIY Province during the year of 1999-

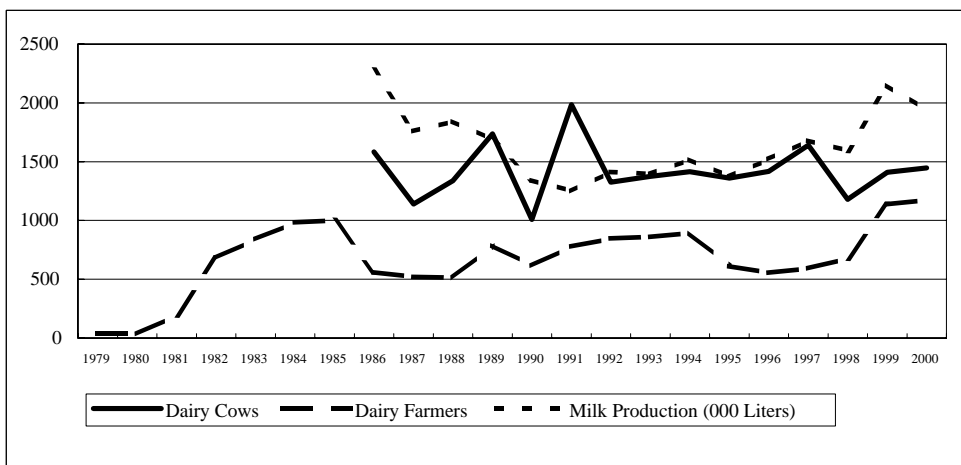


Figure 3. Number of Dairy Cows, Dairy Farmers and Milk Production in DIY Province, 1979-2000

2001.

As of year 2000, Warga Mulya Dairy Cooperative covers the area of Sleman, Bantul Regencies and Yogyakarta Municipality. All the dairy farmers in the province are the members of this cooperative, whose current number is 1,175; Sleman Regency 1,133 members, Bantul Regency 22 members and Yogyakarta Municipality 20 members. It produced 1,9 million liters of milk and had 1,446 dairy cows. From 1999, dairy farming has entered the third phase of steady development after coming through the transformation period of ups and downs and difficult challenges both in dairy farming and dairy cooperative management.

4.1. Dairy Farming of the Cooperative Members

The average number of dairy cows holding by the farmers in DIY Province is 4 and nearly half of them are currently lactating. The average lactation period is 290.4 days and total milk production is 2,000 liters per head per year (**Table 1**).

The rest is composed of equal share of currently dry and heifer, would be lactating in time of 2-12 months, and calves, would be lactating after 24 months with normal rearing. Out of 452 cows surveyed, more than half (152) is provided by cooperative, about one third (128) is produced in self farm by artificial insemination and very few (72) comes from other sources including cooperative of West Java and Central Java through middle man. This composition of cows per farm and the stable sources are vital for dairy development and are regarded as good prospects for future, as well.

Table 1. Dairy Cows Holding and Milk Production among the Dairy Farmers in DIY Province

Description	Number
Average dairy cows holding per household/or farm (head)	4.0
Lactating	1.8
Dry	0.6
Heifer	0.5
Calves	1.1
Average lactation period (days)	290.4
Yearly milk production per head (liters)	2,000

Source: Field Survey, 2001

Note: Total number of samples is 114.

The average lactation period and milk production should be increased by improving breed and feed quality. In order to improve breed quality, artificial insemination has been implemented using almost 860 doses of good quality bull semen in 2000. However, necessary steps will be taken to raise the efficiency of using artificial insemination and selection emphasis on high milk yield of satisfactory composition and good quality will continue to be the breeding goal in the future. Selection for high milk production is still the most important factor for assuring high economic returns to dairy farmers. Therefore, the primary goal of genetic improvement should be directed to increase the annual production of milk per cow and to select for desirable quality and satisfactory milk composition. According to Devendra (1988), improving nutritional management is important factor for economic and high milk yield of good quality. It should be stressed that the energy and protein concentrates for lactating cows are needed more.

There are no farmers who raise seed bull in DIY Province due to the provision of artificial insemination by cooperative and Animal Husbandry Service. The non necessity of raising a seed bull allows the farmers to raise more number of cows, consequently produce more milk. Whenever a male calf is born farmers sell this to the cooperative to pay their credit.

4.2. Cooperative Services

In order to provide these services to the members, Warga Mulya Dairy Cooperative allocates its various resources, such as, members' savings, government subsidy, loan and private company share as shown in **Table 2**. Members' savings activity was started at the beginning of the cooperative establishment in 1979. The cooperative received the government subsidy every year since 1981. At the first time the government subsidy was 450,000 rupiahs and in 2000 it was 6.4 million rupiahs. Since 1979 the cooperative has received the kind of loan from BRI, private bank and UIDC. BRI loan was first time given in 1979 in form of 100 dairy cows. In 1981 UIDC gave loan in the form of 5 cooling units, 100 milk cans and 4 motorcycles. Private bank were involved in the giving of loan since 1988 by giving of 339 million rupiahs to the cooperative. There are two private companies having the part taking in Warga Mulya Dairy Cooperative activities. They are Sari Husada Milk Processing Industry and PT. Bogasari. Sari Husada Milk Processing Industry has share in the cooperative since 1989 worth 68 million rupiahs and PT. Bogasari since 1999 worth 485 million rupiahs. In 2000, the cooperative had 1,825 million rupiahs for use from different sources. About 814 million rupiahs was from state bank loan used for credit disbursement and calf raising. This was followed by members' savings, amounting to 568 million rupiahs, also used for credit disbursement and milk collection. Private company shares used for credit disbursement and feed supply amounted to 315 million rupiahs. Loan from UIDC (76 million rupiahs) was used for artificial insemination and veterinary aid while that from private bank (37 million rupiahs) was used for credit only. Government subsidy (6 million rupiahs) was used for extension and training.

Table 2. Warga Mulya Dairy Cooperative Resources and Their Allocation

Sources	Amount (M Rp)	Allocation
Members savings	567.6	Credit, milk collection
Government subsidy	6.4	Extension, training
State bank (BRI Unit Desa) loan	813.6	Credit, calf raising
Private bank loan	36.9	Credit
Union of Indonesia Dairy Cooperative loan	75.5	Artificial insemination, Veterinary aid
Private company share	325.3	Feed supply, credit
Total	1,825.3	

Source: Warga Mulya Cooperative Report (2001)

Note: Rupiah (Rp) is Indonesian currency; 78 rupiahs = JP Yen 1

Cooperative provides various services related with dairy activities to the members as shown in **Table 3**. More than 80% of the farmers received all these services.

Milk Collection

This service was started at the beginning of the cooperative establishment in 1979. All the farmers use

Table 3. Cooperative Services for Dairy Farming in DIY Province

Services	Service recipients	Percentage
Milk collection	114	100.0
Feed supply	102	89.5
Veterinary aid	112	98.3
Artificial insemination	102	89.5
Cows insurance	114	100.0
Calf raising	93	81.6
Extension	100	87.7
Training	100	87.7
Credit	92	80.7

Source: Field Survey, 2001

Note: Total number of samples is 114. Multiple answers were allowed.

the milk collection service provided by cooperative and sell their milk to cooperative. The payment for milk by cooperative is made on the basis of the quality of milk instead of merely on quantity basis. It is expected that the milk should have a minimum stipulated standard of 3.3% fat and 7.7% Solid Non Fat (SNF) since 1982. Such milk is priced 1,280 rupiahs per liter. This standard is maintained by system of premium and penalty of 14 rupiahs on increase and decrease of 0.1% of fat and/or SNF contains, respectively. The dairy plants also insist on this minimum standard to control the milk quality as a whole. The price is reviewed every six months by a technical team, representative from ministry of agriculture, Indonesia Union of Dairy Cooperatives and milk processing industry.

The advantage of joining milk collection service is that the farmers get routine payment of milk. The payment of milk to the members was made twice a month. In general, the mode of payment of milk is cash. However, since 1997 Warga Mulya Dairy Cooperative also pays in kind by providing cows feed and veterinary health care facilities to the members for proper feeding and maintenance of dairy cows. Because of this service it became easier for the farmers to get animal feed (concentrate) and veterinary health care from the cooperative. They do not need to pay in cash for these purposes.

Cooperative sells this milk to Sari Husada Milk Processing Industry at 1,538.3 rupiahs per liter. Warga Mulya Dairy Cooperative handled about 1.9 million liters of milk in 2000 and made profit about 490.8 million rupiahs. However, farmers in Bantul Regency and Yogyakarta Municipality; having access to other buyers (hotels, hospitals, restaurants, etc), sell a portion of their milk, produced in the morning, directly to them at a relatively better price.

Feed Supply

The basic dairy cows feeding system is grass with concentrate supplement. Concentrates are essential part of the rations in addition to dry matter roughages to increase the capacity of milk production per cow. To fulfill farmers' needs of the concentrates, Warga Mulya Dairy Cooperative established a Cows Feed Unit in 1999. Due to the easier of buying concentrate, there was an increasing of dairy cows holding by the farmers, dairy farmers (cooperative members) and milk production in 1999 and 2000.

The production of concentrates is about 11 ton per day. A regular supply of concentrates to the members is maintained throughout the year by supplying it at their farm gates at, 550 rupiahs/kg, cheaper than the market price. In 2000, it sold 4,014 ton of concentrates worth 2,207.7 million rupiahs.

Cooperative also promotes the use of green fodder, kinggrass (*Pennisetum purpuides*), leucaena

(*Leucaena leucoucephala*) and gliricidia (*Gliricidia sepium*) the cheapest source of nutrient (including protein) enhancing the milk yield at an economical cost. Farmers have the desires to increase milk production, especially by increasing green fodder that would result in lowering the cost and increase the profit. Hence, 90% of farmers make use of this service given by the cooperative.

When the cooperative promotes the use of good animal feed, fodder supply for dairy cows comes mainly from agricultural waste products such as garbage, soybean hulls, sweet potato leaves, young corn leaves and sugarcane top leaves. Farmers also practice grazing under plantation crops, roadside tables and canal bunds, on natural grasses and weeds of varying quality. In using concentrate, the farmers mix the component of concentrate themselves because the price in market was very expensive. In order to minimize the farmer's problem of the expensive price of concentrate, the farmers are allowed to pay the price for concentrate in milk. Components of concentrate are usually rice bran, coconut (*Cocos nucifera*), palm cake, maize (*Zea mays* L), molasses, and cassava (*Manihot utilisima*).

Veterinary Aid and Artificial Insemination

The livestock diseases cause economic loss in dairy business. Bae (1993) mentioned that while preventive care is necessary, it would still be economical to treat the animals due to their high cost. It was also observed that treatment of diseased animal was costly and hence, the veterinary aid service is aimed at the preventive measures in order to reduce the economic losses and the cost.

Cooperative employs the veterinarians and trained stockmen and ensures that every member obtain veterinary aid at his door for his animals since 1985. Veterinarians route in weekly visits arranged for each group of farmers. The farmers are pre-informed about these visits so that they can avail themselves of the services. The treatment of animals during such weekly veterinary visits is free of cost. Apart from the weekly services, emergency services are also provided at very reasonable charge and varying according to the nature of the required service. The cost of emergency treatments is deducted from the sales of the milk. Almost all the farmers make best use of this service.

Artificial insemination gives a better result by improving genetic quality for the next generation and contributes in milk production. It is also regarded as easier method for conceiving than natural mating with one successful pregnancy in every four artificial inseminations (Warga Mulya Dairy Cooperative, 2000). Artificial insemination service was started in 1986. Animal Husbandry Service introduced the using of artificial insemination through the extension activities. At that time the cooperative was collaborating with Animal Husbandry Service in order to hold the extension. In the same year, the government through Animal Husbandry Service gave free of 100 dozes of semen to the cooperative. In 2001 almost all the farmers (90%) use this service, even though the charge of artificial insemination is high (7,500 rupiahs). Farmers also prefer artificial insemination for management efficiency; no need to raise bull would mean economizing of resources that can be used for raising female cows producing milk. The farmers sell male calves to cooperative to pay credit. Price of calf (3 months old) is 800,000 rupiahs.

Cow Insurance and Calf Raising

Cow insurance serves as a measure to decrease the number of inferior cows and increase investment on high quality animals. Removal of the risk of loss on invested capital on animal would encourage farmers to raise more cows. Considering these matters, in 1999 Warga Mulya Dairy Cooperative has established the cows insurance service. Thus, all the farmers are using this service. Members pay

120,000 rupiahs per cow per year and receive 1,800,000 rupiahs, enough to buy a young cow with first pregnancy, when a dairy cow is dead. Defective cow (unable to conceive and lactate) is changed with a new one without any charge. But the farmers thought, it was very expensive and cooperative is considering the cows insurance charge based on the milk yield.

To fulfill the need of replacing all and non-productive dairy cows and maintain the cows population, the cooperative established calf raising unit in 1989. The new born calf owned by the breeder are purchased by the cooperative and raised in the calf raising unit and are sold or credited to farmers after they are grown up and pregnant. In order to support the development of this unit, the government has given loan worth 75 million rupiahs to the cooperative through BRI in 1993. In 2000, Warga Mulya Dairy Cooperative sold and credited 137 dairy cows worth 291,2 million rupiahs to the members. It helps the dairy farmers in reducing the capital constraint on the dairy farming.

Extension and Training

Warga Mulya Dairy Cooperative had considered providing the extension and training program since the beginning of cooperative establishment. The extension program has a great importance in the dairy development in the adoption of better dairy business. Two extension workers provide extension services in the focus area of the cooperative by undertaking activities such as; animal health campaign (preventive vaccination, pregnancy diagnosis and treatment of infertility), milk yield (improving the productivity and maintaining high yielding cow), feeding practices, propagation of fodder cultivation (advantages and methods of cultivation of fodder crops) and breeding improvement (artificial insemination in order to promote a good breed).

Training was designed to address priority needs of members and aimed at giving the members the proper orientation on scientific dairy management and the role of cooperative. Most of the farmers (88%) mentioned that the training has helped them to get new information related with their dairy activities. They hope that the cooperative organizes the training monthly to get more information. But currently cooperative has only two extension workers and are unable to meet this demand of the farmers. Recently, cooperative is collaborating with Sari Husada Milk Processing Industry (seeking stable supply of milk from cooperative) and/or Gadjah Mada University in order to deliver the training needs of the farmers. Strong research-extension linkages and good support services are essential for dairy development. Training field programs and demonstration centers are essential for providing education on all aspects of mixing feeds, improved methods of feeding animal and management of animal.

According to Devendra (1988), for inputs to be used to advantage and for proven technology to be transferred successfully, extension assistance needs to be engaged in demonstration work that not only proves the point, but also motivates the farmers into participation and progress. Self-reliance is implicit, and the motivation of farmers is also enhanced by periodic training, timely inputs and creation of marketing opportunities. Successful appropriate technologies are those that would allow the fullest possible use of local resources and would contribute to particular development objective for dairy production.

Credit

In order to free the farmers from the unfavorable loans by moneylenders and to form working capital, cooperative provides the credit since the cooperative was established in 1979. At the beginning of this service, the cooperative contributed the members' savings as the capital accumulation generated the members. It can be used as sources of working capital. In this case, the cooperative plays a role of rural

intermediary institution by systematically encouraging the members to save and generate capital.

Since 1979 Warga Mulya Dairy Cooperative channels the loan from bank, private company and Union of Indonesia Dairy Cooperatives to the farmers. Cooperative receives loan from BRI and private company (milk processing industry, animal feed industry) and lends money to the members for dairy farming, with a margin in interest rate to bear its service cost. Union of Indonesia Dairy Cooperative gives the credit in the form of equipment to the cooperative. **Table 3** shows that 81% of the farmers are making effective use of this service.

Warga Mulya Dairy Cooperative gives loan to the dairy farmers for buying cows and concentrates on the condition of regular supply of milk to the cooperative. It determines that the payback period of loan to be 18 months to be paid in daily installments from the sale of the milk (10% of its milk produce). But the low milk production causes the longer payback period of loan. According to Annual Cooperative Report, 2000, the average of payback period of loan was 29 months in 1999.

Recently, the cooperative is considering to form a link between the members savings and the cooperative loans and use the information for lender's screening process. By observing the savings behavior of members, the cooperative can judge their credit worthiness and capacity to manage debt, and thus, prevent the cooperative in debtting a member with over loans.

Some farmers in Bantul and Sleman mentioned that the cooperative credit helps them free from extortionate usury and the pernicious *ijon* system². Usually, the small farmers pawned their rice-fields or their *pekarangan* (gardens) that produces coconuts (*Cocos nucifera* L), salacia (*Salacia* L), mangoes (*Mangifera indica* L), jack fruit (*Artocarpus heterophyllus* Lam), and so on, for getting loan for buying animal feed and cows from *tukang ijon* (money lender). As a result, even before the crops on the field have ripened, their ownership has already fallen into the hands of the *tukang ijon*. By means of the cooperative credit, an attempt has been made to be free the members from this intolerable extortion and to prevent those who were free from their debts from being ensnared once more by the *tukang ijon*.

4.3. Dairy Farming Situation After Becoming a Cooperative Member

The dairy farmers in DIY Province are the small farmers and the average number of dairy cows holding is 4. Warga Mulya Dairy Cooperative is involved in the acquisition of dairy cows. More than half of dairy cows are provided by the cooperative. Cooperative also provides various services related with the dairy activities to the members, such as, milk collection, feed supply, veterinary aids and artificial insemination, cows insurance and calf raising, extension and training and credit.

In order to understand the role of dairy cooperative services on dairy development in term of number of dairy cows, milk production, quality of milk, technology, management and labor use and the consequences at the farm level a detailed field study was conducted in the three dairy farming regencies of DIY Province. The data and the information for the analysis were collected from the farmers by sampling method. The questionnaire for this purpose was designed and the personal interview surveys were conducted through the use of this questionnaire.

Warga Mulya Dairy Cooperative in DIY Province was taken for the case study. 114 households of the cooperative members from the three regencies were purposively taken so that they represented all type of areas in DIY Province; mountain area (Sleman Regency), costal and sub urban area (Bantul Regency) and urban area (Yogyakarta Municipality). The author visited all the households and interviewed the people so the farmers can express their ideas directly. But there was still some limitation here. Farmers do not have a special record related with the dairy activities. They could give the infor-

mation if they remember the matter. These limitations were solved by cross checks with the cooperative data, observation or re-interviews. Secondary data was also needed to support the primary data.

Of all the benefits that accrue from the development of dairy cooperatives, the economic incentives, yielding direct and tangible returns, are the ones mostly recognized by the dairy farmers. The direct impact of the dairy cooperatives on the dairy households are various, such as, improvement of milk quality, better technology, better management, improvement of milk production, increase in the number of dairy cows and labor use for dairy farming.

Table 4. Improvement in Dairy Farming after Becoming a Cooperative Member in DIY Province

Changes	Dairy farmers	Percentage
Number of dairy cows	74	64.9
Milk production	95	74.6
Quality of milk	105	92.1
Technology	105	92.1
Management	92	80.7
Labor use	59	51.8

Source: Field Survey, 2001

Note: Total number of samples is 114. Multiple answers were allowed

About 65% of the farmers mentioned that they are raising more number of dairy cows than before becoming cooperative members. About 75% claimed that milk production per cow increased and 92% said the quality of milk has improved (**Table 4**). They said that the cooperative helps to overall improve the dairy farming. About 81% of the farmers consider that dairy farming management has improved by training and extension services of the cooperative and 92% of them apply the new technologies which are using of hay, silage and artificial insemination in their farming, eventually contributing in increasing income from dairy farming. As the number of dairy cows increased, 52% of the farmers use more labor, mostly surplus family labor, in their dairy farming. The contribution of dairy income to the total household income will be discussed in the next section.

4.4. Contribution of Dairy Income to the Household Income

A very high share of agriculture primary employment (88.6%) can be found in the study area. It means that agriculture activity is backbone of income in the rural areas of DIY Province. But in reality, some households have no access to land and a large number of households, who have access to land, are engaged in non-agriculture activities as a secondary activity. There are also some farmers (11.4%) engaged in agriculture as secondary activity. They work in business (5.3%), manufacturing (0.9%), public service (4.3%) and army (0.9%) as the primary occupation (**Table 5**).

The average land holding per household is 2,849.2 m² and consist of wet land (*sawah*) 607.3 m², household compounds (*pekarangan*) 985.2 m², dry land (*tegal*) 1,091.8 m² and fodder land 164 m² (**Table 6**). In the study area, the most common wet land cultivation pattern is three crops a year including two rice crops (February - May and October - January) and one intermediary crop or *palawija* (June - September): usually soybeans (*Glycine max* (L) Merr.) or maize (*Zea mays* L). By far the most common system of sharecropping is the so-called *maro* system, whereby the cultivator and the landlord receive half of the crop and pay half of the total cost each. This system has been traditionally in use in

Table 5. Occupation Structure in DIY Province.

Category of job	Main job		Side job	
	Number	Percentage	Number	Percentage
Agriculture	101	88.6	13	11.4
Business	6	5.3	11	9.6
Construction	-	-	4	3.5
Mining	-	-	7	6.1
Manufacturing	1	0.9	2	1.8
Transportation	-	-	1	0.9
Public service	5	4.3	2	1.8
Army	1	0.9	-	-
Total	114	100	40	35.1

Source: Field Survey, 2001

Note: Total number of samples is 114.

Table 6. Average Land Holding per Household in DIY Province.

Land type	Area (m ²)	Percentage
Wet land (<i>sawah</i>)	607.3	21.3
Household compounds (<i>pekarangan</i>)	985.2	34.6
Dry land (<i>tegal</i>)	1,091.8	38.3
Fodder land	164.9	5.8
Total	2,849.2	100.0

Source: Field Survey, 2001

Note: Total number of samples is 114

wetland areas of the DIY Province. In contrast, the so-called *mertelu* sharecropping arrangement, whereby a third of the harvest goes to the cultivator and the rest to the landlord and the 'cultivator pays all cost' (Hardjono, 1987), is virtually absent from these wetland communities³.

Other main crops are tree crops grown in *pekarangan*. Abdullah (1991) defines the household compounds as "a subsystem within larger food procurement system which aims at production of household consumption items, either not obtainable through permanent shifting agriculture, hunting, gathering, fishing, livestock husbandry, or wage earning. Household compounds supply and supplement subsistence requirements and generate secondary direct or indirect income. They tend to be located close to permanent or semi permanent dwellings for convenience and security."

The crops frequently grown in *pekarangan* are fruits (such as, salacia (*Salacia* L), banana (*Musa paradisiacal* L), papaya (*Carica papaya* L), citrus (*Citrus reticula* Blanco), mango (*Mangifera indica* L), avocado (*Persea Americana* Mill), durian (*Durio zibethinus* Murr) and saponilla (*Manikara zapota*)), vegetables, coconut (*Cocos nucifera*), cassava (*Manihot utilisima*), and clove (*Eugenia caryophyllus*). Most households in Sleman Regency supplement their income by selling salacia (*Salacia* L) fruits of the *pekarangan*.

Also as a consequence of the unavailability of permanent irrigation, there is *tegal*, apart from the *pekarangan*. Maize (*Zea mays* L), soybeans (*Glycine max* (L) Merr) and cassava (*Manihot utilisima*) are the crops that grown in *tegal*. Some farmers use *tegal* for cultivating fodder to fulfill the need of fodder for the dairy cows. There is also the farmers who use wetland for cultivating fodder (kinggrass

(*Pennisetum purpuides*), *Leucaena lecoucephala*, and *Gliricidia sepium*). The land used for cultivating fodder contributes 7.5% to the household income. In Sleman Regency, farmers sell the surplus production of fodder to the farmers in Yogyakarta Municipality or Bantul Regency.

The land related with dairy activities is wetland, fodder land and household compounds. The waste product for agriculture that produced on wetland and grass that cultivated on fodder land are the main sources of animal feed. The farmers established the stable on house compounds. According to Hermanto (1991), it is traditional for Javanese people to keep their animals in the household compounds, to keep their animals safe and to ensure that the animals are managed easily.

Table 7 presents estimated the gross income from milk production, selling cows, selling calves, and selling manure. The total gross income from dairy activities per household is 13.5 million rupiahs per year. The highest share is from milk production (48.1%) followed by selling cows (32.6%). In the management efficiency of the dairy enterprise, the farmers cull some dairy cows, which have low production, injury, reproductive problems, and then sell them. Farmers also sell the male calf to pay the installments of cooperative credit. The other reason is that farmers do not need to raise a bull for breeding since the cooperative provides artificial insemination service.

Some farmers raise poultry (chicken and duck), goat, sheep, cows and also fish in fishponds in the *pekarangan* and gain some income, as well.

Table 7. Gross Income from Dairy Farming per Household in DIY Province.

Gross income	Amount (million Rp)	Percentage
Selling cows	4.4	32.6
Selling calves	1.9	14.1
Milk production	6.5	48.1
Manure	0.7	5.2
Total	13.5	100.0

Source: Field Survey, 2001

Note: Total number of samples is 114. Rupiah (Rp) is Indonesian currency; 78 rupiahs = JP Yen 1

Table 8. Share of Dairy Farming in Household Income in DIY Province

Income from	Amount(million Rp)	Percentage
Crop	4.2	17.5
Dairy	13.5	56.3
Livestock non dairy	0.2	0.8
Non agriculture	6.1	25.4
Total	24.0	100.0

Source: Field Survey, 2001

Note: Total number of samples is 114. Rupiah (Rp) is Indonesian currency; 78 rupiahs = JP Yen 1

Dairy farming contributes significantly to the household income amounting to 13.5 million rupiahs per year. **Table 8** shows that the total share of dairy income is more than half (56.3%) of the total household income, much more than the share of crop production (17.5%) and non-agriculture work (25.4%). However, the income from non dairy livestock is small (0.2%) and has no significant contribu-

tion to the total household income.

The average share of crop to household income among the farmers in DIY Province is 17.5% and came from crop production in the various kinds of land held by the farmers; *sawah*, *pekarangan*, *tegal* and fodder land. The share of income from non-agriculture to the household income is 25.4% (**Table 8**)⁴.

5. Conclusion

The dairy cooperative was introduced in Indonesia in early 60's with the introduction of dairy cooperative in East Java which serviced the cooperative members by collecting milk. But it could not take roots there. It started to take off only systematically under the umbrella of UIDC during early 80's after the introduction of various other services under the 'Cooperative Model' in 1983 and continues government support. Then it went through the transformation period of ups and downs during late 80's and 90's. The cooperatives under UIDC system are functioning well and providing systematically various services need for development of dairy farming. Accordingly, cooperative members, dairy cows and milk production have increased recently in Indonesia. Dairy farming is on the way to sustainable growth after 1999. Similar trends are observed in DIY Province, where dairy farming is served by Warga Mulya Dairy Cooperative with all the dairy farmers being its members. Here, the dairy farming has very stable composition of cows at household level with good future prospects and produces 2,000 liters of milk per head per year. Warga Mulya Dairy Cooperative allocates effectively its various resources from different sources for the services to its members. Most of the farmers make best use of all the services provided by the dairy cooperative and improve their dairy farming. Dairy farmers are also well satisfied with the cooperative services and perceive that their dairy farming management has become better in almost all the aspects. The performance of Warga Mulya Dairy Cooperative was so good that it was the best cooperative in among all kind of cooperatives in DIY Province during the year of 1999-2001. Consequently the income from dairy farming has a very high share, more than half, in the household income of the cooperative members, significantly raising their total household income.

Thus, it can be said that dairy cooperative is instrumental in directly alleviating the income of its members and also benefits indirectly the rural region at large, by generating substantial employment and investment opportunities in animal feed industry, bank and other related activities. However, there are still problems that cause the slow development of dairy farming. Frequent government policy changes and over dependence of the cooperatives on such policies are some of them⁵.

The milk production is far away from fulfilling the domestic demand and much has to be done in pricing policy to give incentive to the farmers. On the issues of fair pricing of milk, the balance should be struck between the interest of the consumer and that of the dairy farmers. In this regard, government needed to decide to what extent it was willing to support prices and this would depend largely on how much government funds were available to undertake a program such as a subsidy scheme.

The government should also be actively involved in cow insurance program in order to attain sustainable dairy development that will be used as an effective instrument for rural employment and rural development as a whole. These issues are worth exploring in the future.

Appendix 1. Chronology of Dairy Farming and Dairy Cooperatives in Indonesia

Year	Dairy Farming	Dairy Cooperatives
1905	Dutch introduced dairy cows in Java island.	
1940s 1950s	Holstein Friesian dairy cows distributed to the local farmers in East Java, Central Java and West Java.	
1962		First dairy cooperative established in Pujon (East Java).
1967		Dairy cooperative established in Nongkojajar and Pasuruan (East Java).
1969		Dairy cooperative established in Pangalengan and Sukabumi (West Java).
1969 1979	Introduction of services i.e., artificial insemination and feed improvement program to increase dairy production during first and second Five Years Development Plan by Indonesia Government	
1970		Dairy cooperative established in Bogor (West Java).
1978	Pricing of milk based on fat and SNF contents introduced by UIDC. Annual milk production was 62.3 million liters. Farm gate price of milk was 40 - 80 rupiahs per liter.	Dairy cooperatives established in Grati, Ungaran, Boyolali and Solo (Central Java) and Garut (West Java). UIDC was established. There were 11 dairy cooperatives with 2,800 cooperative members and 48,600 dairy cows in Indonesia.
1979	Indonesia imported 3,800 dairy cows from Australia and New Zealand.	Warga Mulya Dairy Cooperative established in Daerah Istimewa Yogyakarta.
1979 1984	During third Five Years Development Plan Indonesia Government worked together with Union of Indonesia Dairy Cooperatives and made the obligatory for the milk processing industry to buy the milk produced by the small farmers	.
1981	Indonesia imported 36,200 dairy cows from Australia and New Zealand.	UIDC started to give credit in form of equipment of cooling units, milk cans, and motorcycles to the dairy cooperatives.
1982	Dairy Technical Team which consist of Minister of Industry Affairs, Ministry of Trade and Cooperatives and Ministry of Agriculture was established in order to: <ol style="list-style-type: none"> 1. Determine the milk price purchasing price agreement between the milk processing industry and the dairy cooperatives. 2. Determine ratio between domestic milk production absorption and the volume of powdered milk, which could be imported. Indonesia imported 36,200 dairy cows from Australia and New Zealand.	UIDC was involved in the reviewing of milk price every 6 months.
1983	The result of dairy Technical Team establishment was increasing of milk price 300 - 328 rupiahs per liter. Indonesia imported 67,000 dairy cows from Australia and New Zealand.	"Cooperative Model" introduced.
1984	Milk production was 227.2 million liters. Milk consumption was 622.8 million liters.	
1984 1989	During fourth Five Years Development Plan, the target to fulfill 50% of the total milk requirement through domestic production by 1989 was set.	

1985	<p>Declaration of Presidential Decree Number 2 regulated national dairy development by linking seven ministries: Ministries of Agriculture, Industry and Trade, Cooperative, Health, Home Affairs and Investment Coordination Board. Government provided support facilities to increase livestock productivity:</p> <ol style="list-style-type: none"> 1. Establishment of artificial insemination center in Lembang (West Java) and Singosari (East Java). 2. Establishment of disease investigation center in DIY Province. 3. Establishment of dairy training center in Batu (East Java) and Baturaden (Central Java). 	
1989	Target could not be met. The total milk consumption was 761 million liters but the domestic milk production was only 292.8 million liters.	
1989 1994	During fifth Five Years Development Plan, target to increase domestic milk production to fulfill 50% of the need for domestic milk consumption.	
1994	The target during 1989 - 1994 could not be met and Indonesia still imported 602.8 million liters (more than 50% of the need for domestic milk consumption). National milk consumption was 862.1 million liters and domestic milk production was 385.5 million liters.	
1994 1999	During sixth Five Years Development Plan also target to produce 50% of domestic need.	
1999	<p>There were 80,931 dairy farmers and 324,719 dairy cows in Indonesia. The target of domestic milk production should be achieved 50% of the total milk need could not be realized. National consumption was 966.7 million liters and the domestic milk production was only 378.9 million liters. Indonesia imported 509.5 million liters equivalent fresh milk.</p>	<p>There are 4 main dairy cooperatives in Indonesia, namely <i>Sinau Anadadni Ekonomi</i> (Pujon, East Java), <i>Kemusuk</i> (Boyolali (Central Java), <i>Bandung Selatan</i> (Pangalengan, West Java) and <i>Warga Mulya</i> (DIY).</p>

Appendix 2. Chronology of Dairy Farming and Dairy Cooperative in Daerah Istimewa Yogyakarta Province

Year	Dairy Farming	Dairy Cooperative
1930s	Dairy cows introduced in Yogyakarta Municipality.	
1940s	Dairy cows introduced in Bantul Regency.	
1979	There were 35 dairy farmers in Yogyakarta Municipality and Bantul Regency.	Warga Mulya Dairy Cooperative established. Its areas were Yogyakarta Municipality and Bantul Regency. Cooperative office was located in Yogyakarta Municipality. Services provided by the cooperative were milk collection, extension and training, and credit. Warga Mulya Dairy Cooperative joined in UIDC. Warga Mulya Dairy Cooperative received credit from BRI in the form of 100 dairy cows.
1980		Warga Mulya Dairy Cooperative received credit of 200 dairy cows from BRI and passed them to farmers in Yogyakarta Municipality and Bantul Regency.
1981	Dairy cows were introduced in Sleman Regency by giving credit of 150 dairy cows to the farmers. The number of dairy farmers was 193.	Warga Mulya Dairy Cooperative received credit of 150 dairy cows and passed them to farmers in Sleman Regency. Areas of the cooperative were Yogyakarta Municipality, Bantul and Sleman Regency. First, the government gave subsidy to the cooperative worth 450,000 rupiahs. UIDC credited 5 cooling units, 100 milk can and 4 motor cycles to the cooperative.
1982	Pricing of milk based on the fat and SNF contents was introduced in DIY. The number of dairy farmers was 682.	Warga Mulya Dairy Cooperative received credit of 327 dairy cows from BRI.
1983	The number of dairy farmers was 841.	Warga Mulya Dairy Cooperative received credit of 310 dairy cows from BRI.
1984	The number of dairy farmers was 983.	Warga Mulya Dairy Cooperative received credit of 400 dairy cows from BRI.
1985	Disease Investigation Center was established in DIY in order to increase livestock production. The number of dairy farmers was 1002.	Cooperative started to provide the veterinary aid service to the members.
1986	Artificial insemination was introduced in DIY. There were 560 dairy farmers and 1583 dairy cows. Milk production was 2.3 million liters	Animal Husbandry Service gave free of 100 dozens of semen to the cooperative.
1987	There were 520 dairy farmers and 1,139 dairy cows. Milk production was 1.8 million liters.	
1988	There were 514 dairy farmers, 1,338 dairy cows and milk production was 1.8 million liters.	Cooperative received credit of 339 million rupiahs from private bank (Bukopin bank).
1989	Farmers in Sleman Regency received the second credit from <i>BRI</i> . There were 788 dairy farmers, 1,737 dairy cows and milk production was 1.7 million liters.	Cooperative received credit of 250 dairy cows from <i>BRI</i> and passed them to the farmers in Sleman Regency. Cooperative established the calf raising unit and Sari Husada Milk Processing Industry contributed share of 68 million rupiahs in this unit.
1990	There were 615 dairy farmers, 1,009 dairy cows and milk production was 1.3 million liters.	
1991	There were 779 dairy farmers, 1,984 dairy cows and milk production was 1.3 million liters.	Cooperative office was moved to Sleman Regency.

1992	BRI through the cooperative took back dairy cows credited to farmers in Sleman Regency in 1989 because farmers never paid the reimbursement of credit, due miscommunication. There were 847 dairy farmers, 1325 dairy cows and milk production was 1.4 million liters.	
1993	There were 861 dairy farmers, 1,375 dairy cows and milk production was 1.4 million liters.	Government through Agriculture Department gave grant worth 75 million rupiahs to support the calf raising unit.
1994	There were 895 dairy farmers, 1,415 dairy cows and milk production was 1.5 million liters.	
1995	There were 611 dairy farmers, 1,360 dairy cows and milk production was 1.4 million liters.	
1996	There were 554 dairy farmers, 1,417 dairy cows and milk production was 1.5 million liters.	
1997	There were 592 dairy farmers, 1,639 dairy cows and milk production was 1.7 million liters.	Cooperative made a link between the services; collect milk from the farmers and pays in kinds by supplying feed and maintenance of dairy cows.
1998	There were 677 dairy farmers, 1,180 dairy cows and milk production was 1.6 million liters.	
1999	The number of dairy farmers, dairy cows and milk production increased as the consequences of establishment of cows feed unit and receiving credit for buying of cows by Warga Mulya Dairy Cooperative. There were 1138 dairy farmers, 1,409 dairy cows and milk production was 2.1 million liters.	Cooperative established Cows Feed Unit to fulfill farmers' need of concentrate and also established cows insurance service. PT. Bogasari contributed share in the cooperative worth 485 million rupiahs. It was used for buying dairy cows credited to the farmers and equipment of milk pasteurization. Cooperative provides the pasteurization milk to the consumers.
1999 2001		Warga Mulya dairy Cooperative was the best cooperative among all kind of cooperatives in DIY Province.
2000	There were 1,175 dairy farmers, 1,466 dairy cows and milk production was 1.9 million liters.	Cooperative handled 1.9 million liters of milk and made profit 490.8 million rupiahs. Cooperative sold 4,014 ton of concentrate worth 2,207.7 million rupiahs. Cooperative sold and credited 137 dairy cows worth 291.2 million rupiahs from calf raising unit.

Endnotes

- ¹ For the milk production, farmers clean the dairy cows, feeding area, stable area, and the milk equipment themselves.
- ² *Ijon system* is the credit system very commonly practiced in rural areas of Indonesia. The interest rate is 20% per month.
- ³ The *mertelu* sharecropping system can be found in communities with dry land where the supply of productive farmland is limited. In such communities, cultivators sharecropping dry land are forced to be less demanding (Rotge, 2000).
- ⁴ It should be mentioned that DIY Province had been selected for sugar cultivation the year preceding the implementation of the fieldwork. This occurs once every five years. During such periods, wetlands are rented out by the Madukismo sugar company which carries out the cultivation work. As a result, household members probably have to find alternative employment while household income might be below its normal average when the rice is cultivated.
- ⁵ This issue is also identified by Baswir (1997).

References

- Abdullah, Oekan S. (1991), Definition and Ecology of Homegarden, M.E. Daw, K.V.A. Bavappa and Effendi Pasandaran eds., Proceeding on Pekarangan Land: Development Possibilities and Their Contribution to Farmers' Welfare, Bali, Organized by Center for Agro-Socioeconomic Research, Ministry of Agriculture with Food and Agriculture Organization of United Nations (FAO), 49-59.
- Bae, Sang-Ho. (1993), Control of Animal Health and Diseases, Tokyo, Asian Productivity Organization Study Meeting.
- Baswir, Revrisond. (1997), Indonesia Cooperatives, Yogyakarta, Badan Percetakan Fakultas Ekonomi (BPFE). (in Indonesian)
- Devendra C. (1988), Feeding and Nutrition, Tokyo, Asian Productivity Organization Study Meeting.
- Etgen, William M. and Reaves, Paul M. (1987), Dairy Cattle and Management, 6th Ed., New York, John Wiley & Sons, Inc.
- Hardjono, Joan. (1987), Land, Labour and Livelihood in a West Java Village, Yogyakarta, Gadjah Mada University Press.
- Hermanto. (1991), The Role and Performance of *Pekarangan* in the Farm-Household System in East Java, M.E. Daw, K.V.A. Bavappa and Effendi Pasandaran eds., Proceeding on Pekarangan Land: Development Possibilities and Their Contribution to Farmers' Welfare, Bali, Organized by Center for Agro-Socioeconomic Research, Ministry of Agriculture with Food and Agriculture Organization of United Nations (FAO), 179-194.
- Indonesia Central Bureau of Statistics. (1997), Statistical Yearbook of Indonesia, Jakarta, Government of Republic of Indonesia.
- Kartadihardja, Erwin Soetirta. (1988), Dairy Farming in Asia, Tokyo, Asian Productivity Organization Study Meeting.
- Rotge, Vincent L. (2000), Lowland communities of the plain of Bantul, Vincent L. Rotge, Ida Bagoes Mantra and Ryanto Rijanta eds., Rural Urban Integration in Java Consequences for Regional Development and Employment, Burlington, Ashgate Publishing Company, 61-116.

Union of Indonesia Dairy Cooperatives. (2000), Company Profile, Jakarta, Union of Indonesia Dairy Cooperatives.
Warga Mulya Dairy Cooperative. (1987-2001), Annual Report, Yogyakarta, Warga Mulya Dairy Cooperative.