PROPOSAL CONTENT

1. Importance/ Significance of Research Work.

In Bangladesh, Livestock is generally raised by marginal and small farmers rather than by big commercial farmers with the exception of few Govt. farms. Estimated cattle population in Bangladesh is about 23 millions. Most of the cattle is of indigenous and non-descriptive type. Consequently, their productivity is very low in comparison to that of national requirements. Inspite the livestock is one of the resourceful sector in the agrarian economy of Bangladesh, the nation suffers each year for a potential shortage of milk and meat for its people. Such ill growth of livestock sector in Bangladesh is thought to be the hindrance to the development of the national economy and the nation as well.

Several efforts, time to time, have been made to grade up the genetic quality of the "Local" cattle in Bangladesh, but still the success is of far reaching. Genetic improvement of cattle in Bangladesh has made little progress in the last 30 years by the use of AI technique. Successful livestock development needs changes in several components of production practices. In recent years, there has been a dramatic increase in the number of private dairy farms as well as in the number of cross-bred animals of better yielding capacity throughout the country. At present, there are about 20,000 registered mini and small scale private diary farms and about 2.3 millions of improved cross-bred dairy animals in the country. A comprehensive AI network throughout the country consisting of about 900 AI sub-centres and AI points, 22 district AI centres including the Central Cattle Breeding Station(CCBS) in the premises of the **National Dairy Farm, Savar,** Dhaka is working as the core of the network program to improve the genetic quality of the native cattle using both liquid and deep frozen semen. Now, with all efforts, an alternative quick development approach in the strategy of livestock development of Bangladesh is of importance for sustainable economic development of the country and to fulfil the incremental demand of the growing population. From that standpoint, Bovine Embryo Transfer(ET) technique might be considered as an appropriate technology in the arena of livestock development in Bangladesh as the potential benefits of ET is established and well recognized in developed and in many developing countries.

Cattle embryo transfer attempts to produce a number of excellent calves with superior genetic merit by first selecting a cow(Donor) with good genetic makeup, sound body conformation, higher reproductive efficiency and outstanding strength, then artificially inducing the production of a number of fertilized eggs, superovulation; and finally, transferring them into the uterus of other cows(Recipients). This helps to quick development of breeds with desired genetic potentiality as well as profits. ET is thought to be more advance and rapid breeding tool of cattle development. Though ET technique is complex and expensive, however, it has some advantages over AI technique in the process of genetic improvement of cattle. In AI technique, improvement of the breed is mostly limited to the paternal side. On the other hand, improvement from the maternal side is very slow, because cows are uniparus with a gestation period of 280 days and a reproductive life span of about 10 years. Under normal condition with AI technique, a cow produces only 7-8 calves in its life time. But one ET operation may produce as many calve as the cow is capable of producing in 10 years. Thus, through ET, from a single donor cow of excellent genetic quality many offsprings may be produced having similar high quality genes in a very short time. It is expected that in near future the ET technology would be improved more, the cost will decline and most farmers will be able to be benefited from these techniques(Sakai,1992). Since this is a new and complex technique, there is much more room for further improvement. The impact of ET in cattle breeding should not be considered only in today's context, but also in a future context of increasing technology that will generate new possibilities and nuisances (Willson J.M.,1988).

In fact, genetic improvement of a population is a long term issue and expensive also. Various methods have been used in home and abroad for genetic improvement of cattle. However, a new option is being used in different countries in the magnitude of genetic improvement of cattle which use the new technology of Multiple Ovulation Embryo Transfer(MOET) in an Open Nucleus Breeding System(ONBS). In the process of **ONBS** with MOET, a genetically **"Superior Nucleus Herd"** is established under controlled conditions where testing and genetic selection are carried out. The test group is first established by screening the base population for outstanding females. They are then recorded individually in the Nucleus Herd and the elite females among them are used by MOET with superior sires to contribute embryos which are carried by recipient cows from the base population. The resulting offspring are reared and recorded and the males among them are evaluated genetically using the performance of their sibs, parental half-sibs and their own performance. From these, an elite group of males with high breeding value is selected which is further used in the base population for genetic improvement. The ONBS with MOET yields higher rates of genetic progress per annum than the traditional progeny testing system mainly because of the simplicity in use and of the shorter generation interval. It permits control of the mix of genes released to the base population. The ONBS is also flexible for the introduction of exotic germplasm from other populations. The advent of ONBS in combination with Cellular Bio-techniques may offer a new means of achieving quick genetic progress using the **'Sibling test'** instead of **'Daughter test'** in field progeny testing program. The system makes use of 'Full' and 'Half-sibs' to estimate the breeding value of males under test. The female offspring are considered as potential elite females for Cellular Bio-techniques for the next cycle. The ONBS with MOET is specially valuable for developing countries where the use of field progeny testing has largely been a failure due to the need for an established infrastructure for field recording(John Hodges, 1990). Several projects of ET with the establishment of Nucleus Herds were initiated in Denmark, France and U.K.(Christensen, 1991). In the meantime, **"A Feasibility Trial on Bovine Embryo Transfer Technique"** was carried out for the first time in Bangladesh and was brought in a process of 'Expert Exchange' program of "Japan International Cooperation Agency(JICA)" in the Central AI Laboratory of Savar Dairy Farm in 1995. In the trial, altogether 21 embryos were harvested out of 4 donors and for the first time it was a brilliant success. A demonstrative embryo transplantation was made using only 6 embryos into 6 recipients each due to lack of readily available recipients for fresh ET in time. Eventually a very good result was found for both pregnancy and calving rates and it were 67.7% and 50% respectively. Two recipients failed to calf might be due to early embryonic death or due to unknown causes. In the process of this trial, one JICA expert and two other scientists of Bangladesh; **DR. Talukder Saiful Islam** and **Mr. Shaheb Ali** of **Central AI Laboratory, Savar**, Dhaka were involved in the trial as the counter part as well as trainees of the process of 'Technology Transfer' by JICA in Bangladesh. The JICA expert concluded his wise recommendation to the outcome of the trial in 1995 as 'excellent' and quoted that the preliminary success suggested a good possibility to practical use of Embryo Transfer technique in cattle breeding of Bangladesh. But the new technology could not be continued any longer due to lack of systematic approach and financial support from else where. Since the preliminary success in 1995, it has long been felt to under take a systematic approach to continue the new technology of animal breeding in Bangladesh, having favorable facilities and atmosphere, by using Cellular Bio-techniques. Moreover, the Principal Investigator of this proposed work has recently return from Japan having advance training on AI and Embryo Transfer technology as part of technical cooperation of JICA in Bangladesh .Two co-investigators ; **DR. Delwar Hossain Molla** and **DR. Md. Ainul Haque** were also trained in Germany in the field of relevant technology. Therefore, it might be concluded that with an appropriate breeding plan using ONBS in combination with Cellular Bio-techniques, it might be possible to establish a sound base of **'Superior Dairy Herd'** in the **National Dairy Farm, Savar** to produce better quality cattle having defined genotypes with superior blood lines in Bangladesh in a very short time.

2. Literature Review.

Heap(1890) of Great Britain was the first to succeed in embryo transfer by producing four offspring. Then Biedl el. al (1922), Nicholas(1933), Pincus and Enznann(1934), Chang(1948) and Dowling(1949) reported their successes in early embryo transfer in rabbits. Successful examples of ET in other animals were then reported; Sheep and Goat(Warick and Berry,1949), Shep(Lopyrin et al., 1950). The first successful ET in cattle was performed by Willet et. al. of Cornell University, U.S.A., in 1951. This was followed by similar attempts in many countries using large domestic animals with a few successes until about 1960. In 1965, Sugie of Japan succeeded in non-surgical embryo transfer for the first time in the world. His method soon became well known as the cervix bypass method, or the Sugie Method. However, in the course of time from 1891, the ET technique has been developed much and refined to make it as conventional as possible to practical use in different species of animals. Thus, the conventional cattle embryo transfer technology includes ; Selection of Donors, Superovulation Treatments on Donors, Estrus Detection of Donors, Artificial Insemination of Donors, Embryo Recovery and Evaluation, Estrus Synchronization of Recipients to Donors, Embryo Transfer and/or Cryo-preservation. In recent years, additional related cellular biotechnology like manipulation of embryo for sexing, twin production, IVF, IVM, embryonic and somatic cell coloning, Nuclear transplantation and production of transgenic animals have been developed in the world of ET technology.

2.1. Selection of Donors.

For successful embryo transfer economically productive and healthy cows should be chosen as donors. Healthy cows with superior genetic makeup showing at least twice normal estrus cycle should be chosen. Cows with reproductive disorders, irregular estrus cycles, clinical or sub-clinical endometritis, post-partum anestrus period or other problems are not suitable as donors. Wagner(1987) reported that superovulatory response of heifers and very old cows are generally poor. The ideal cow is 4 to 9 years old with normal sized reproductive tract, no signs of endometrities and vaginities, regularly cycling, well nourished and with a regular calving records(Wagner,1987). However, according to Elsden and Seidel(1985), selection should be made on three main criteria; genetic superiority, reproductive ability and market value.

2.2. Superovulation Treatments on Donors.

A cow is a uniparaus animal, and thus it usually ovulates a single egg in an estrus cycle. An effective application of ET technology is to induce multiple ovulation. To achieve this, many kinds of Gonadotrophic hormones(GTH) are given to the donors to induce the production of many eggs. This treatment is called superovulation induction or multiple ovulation induction. Since, Casida et al.(1940, 1943), there have been many reported studies on the superovulation induction treatment process in cows(Foote & Onuma,1970; Gordon,1975; Betteridge,1977). For superovulation treatment, Folicle Stimulating Hormone(FSH) or a Gonadotrophic Hormone(GTH) such as Pregnant Mare's Serum Gonadotrophin(PMSG) and PGF2α are mainly used. Since the discovery of PGF2α's strong leuto-regressive effect, it has been applied to synchronization of estrus as well as other uses; in superovulation induction by using a combination of PGF2α with PMSG or FSH, the treatment has become easier since there is not as much trouble with the donor's estrus cycle. In practice, super ovulation treatment starts between days 9 and 14 of the cycle, the day of previous estrus being set as the Day 0(Betteridge,1977; Maciel,1991). Jainuddin et al.(1966), reported that the overian response declines under repeated PMSG usage because an antibody is formed. Superovulation with PMSG is generally done by a single injection of 1500 – 3000 I.U. of PMSG(Wagner,1987). However, Elsden et. al.,(1978) reported that superovulation treatment with FSH resulted more ovulations leading to more embryos of better quality and subsequently more pregnancies. FSH is usually administered in total of 24 – 50 mg. There are three methods of administering FSH; Constant dose level throughout the period, Day by day decreasing in dosage(Elsden et. al., 1978) and Gradual increases in dosage with a decrease on the last day(Crister et. al., 1980). Bellows et. al.(1969), Lubbadeh et. al.(1980), Chupin and Procureur(1983), and Elsden et. al.(1978) reported that the best method is to decrease the dosage. Further studies should be conducted to establish theoritical basis and clarify whether the method is really effective or not. Seidel et. al.(1978) and Elsden et. al.(1976) reported good results from a treatment using a combination of FSH with LH in a 5:1 ratio, but the effectiveness of LH is not clearly known. However, a leutilytic dose of PGF2α is usually injected 48 hours after initiation of the treatment(Maciel,1991).

2.3. Estrus Detection of Donors.

Estrus detection of donors is one of the important factor in superovulation treatment. In Canada and U.S.A., only standing estrus is used as favorable sign. When estrus induced by GTH hormones(PMSG or FSH) and PGF2α, more than 68 – 80% 0f donors exhibit estrus, and in addition, most of those not showing signs also ovulate(Betteridge,1977). Hasler et. al.(1983) reported that when_cows with reproductive disorders were treated as donors, the estrus occurrence rate was 81%, however, the rate in other cows was greater than 90%. Takahashi(1983a) reported that in many cases either no eggs were recovered or many unfertilized eggs were found in donors which showed estrus later than the 3rd day post- PGF2α administration. In general, estrus appears within 40 – 48 hours after PGF2α or PGF2α analogue administration.

2.4. Artificial Insemination of Donors.

In general, the best period of AI is 10 – 24 hours post-standing estrus. A high rate of fertilization is expected in this method. Estrus induced by a superovulation treatment should cofirm to this method. When frozen semen is used with a superovulation treatment, two straws or amples of frozen semen are applied several times every 8-12 hours. According to Crister et. al.(1980), even one insemination of an ample 12 hours after confirmation of estrus resulted in a satisfactory rate of normal eggs, however, other researchers reported that applying sperm several times increases the rate. Newcomb(1980) reported that an additional insemination after the estrus subsides is important. Moreover, the quality of sperm is another factor.

2.5. Embryo Recovery and Evaluation.

Ovulated eggs are fertilized in the ampulla of the oviduct and become embryos. Then embryos move to the isthmus of the oviduct, utero-tubal junction, and apex of the uterine horn, while continuing egg mitosis. These developmental stages and locations show slight differences between individuals; however, in general, embryos remain in the oviducts for 4 days post-insemination, are in the utero-tubal junction on the 5th day, and apex of the uterine horn on the 6th day. After the ovulated eggs become embryos, 80-90% of the embryos move down into the uterus on the 5th – 6th day of the estrus cycle. During this period, the egg collection instrument(Uterine balloon catheter) is inserted into the uterus and flushing is performed, thus the embryos are recovered non-surgically. Embryo recovery by non-surgical uterine flushing was reported by Rowson and Dowling(1949). Sugie et al.(1972), improved 3-way method appliance in uterine flushing method. Newcomb et. al.(1978a) succeeded in placing a catheter near the apex of the uterine horn by pushing it through a leading tube which had been previously inserted deep enough to reach the uterine horn via the cervical canal. The embryo flushing is done generally at day 6 to 7 post insemination at the morulla and/or blastocyst stage with flushing medium followed by a spinal epidural anesthesia administered by 3 – 5 ml. of 2% procaine hydrocloride xylocaine. After recovery of embryos, the uterine contents are filtered and searched the embryos out of the flushing medium and washed in PBS with 10% Bovine Serum Albumin(BSA). Then the embryos are evaluated under Inverted or sterio microscope at higher magnification for quality. The evaluation is based on the standard of International Embryo Transfer Society(1987).

2.6. Estrus Synchronization of Recipients.

Embryo transfer could not be successful unless the uterine environment of the donor and recipient are similar. This is the reason why their estrus cycles have to be synchronized. Pharriss and Wyngarden(1969) discovered the strong tendency of PGF2α to cause regression of the corpus luteum. Rowson et. al.(1972) first induces estrus synchronization successfully by injecting PGF2α into the uterus. But the easiest way to inject it intramascularly. This became very popular since Lauderdale(1972) reported an effect similar to that obtained by direct injection into the uterus when they injected 30 mg. of PGF2α intramascularly. Many researchers reported that 30 mg. is needed for single administration(Lauderdale et. al., 1972; Stellflung et. al., 1973; Roche,1974). But according to some recent reports, administration of less than 10 mg. produced satisfactory effects. However, the effects seem to be dependant on the environment or physiological condition of the cow. Many researchers have reported that at least 15 mg. of PGF2α should be administered(Nakahara et. al., 1975; Sugie et. al., 1978; Kaneda et. al., 1978). It has been reported that more than 90% of the cows/heifers exhibit estrus and ovulation at 48 – 72 hours after PGF2α administration(Cooper,1974; Ellicott et. al.,1974).

2.7. Embryo Transfer and/or Cryopreservation.

The early development of a method of transferring embryos through the uterine cervical canal without applying either anesthesia or surgery, analogue to the recto-vaginal method in AI, had been expected for a long time. Now , the procedure is as simple as conventional AI technique. Sreenan(1975) and Boland et. al.(1975) performed embryo transfer with a semen syringe originally used in AI. Since then the uterine cervical canal method using a semen syringe has been tested in many experiments with good pregnancy results. According to Wright(1981) the embryo insemination gun is inserted into the vagina passed through the cervix and extended upward to deep into the uterine horn ipsilateral to the ovary with an active corpus luteum. After successful transfer of embryos, pregnancy is usually confirmed at Day 40 to Day 60 post estrus by per rectum examination. Early pregnancy diagnosis can be done by using Ultrasound Scanning method(Albihn et. al., 1991). In routine ET practice, it is necessary to develop a conventional embryo preservation technique with a view to both short and long time preservation for use in need. Generally, the good quality embryos, excess in comparison to readily available synchronized recipients, are preserved using cryo technique with glycerol or ethylene glycol in 0,25 ml. Frech type straw for future use. In 1972, Whittingham et. al. succeeded in obtaining live births from mouse embryo that had been stored at –196°C using Dimethyl Sulfoxide (DMSO) as a cryo protectant. Recently, by many researchers successful cases using frozen bovine embryos have been reported since the successes obtained by Sugie et. al.(1979) by using both glycerol and ethylene glycol as cryo protectant.

3. Objectives of the proposed work.

The **National Dairy farm, Savar** has long been working as the core of Dairy herd improvement in Bangladesh since 1962. The visible genetic improvement of dairy cattle in Bangladesh, so far achieved, would certainly be credited to the **National Dairy farm, Savar**. But still, the rate of progress is considerably slow due to the use of traditional technologies in the field of livestock development in Bangladesh. Hence, with a view to bring a radical change in the production practices of dairy cattle in Bangladesh, the proposed research work , within the perspectives of **Cellular Bio-techniques** used in modern animal breeding systems, would attempt mainly to highlight the following;

i) Testing and identification of '**Genotype**' and '**Blood Level**' of dairy cattle suitable under the climatic conditions of Bangladesh by using modern **Cellular Bio-techniques** .

ii) Development of **Cryo-biological** technology with a view to make efforts of establishing a future '**Gene Bank**' to conserve valuable genetic resources for future use in the field of animal breeding in Bangladesh. Also attempts would be made to find out the possible ways and means to extend over the outcome of the research at farmers level in the way of conventional '**Technology Transfer**' process.

iii) Development of a foundation group of "**Superior Nucleus Breeding Herd**" of defined genetic merit in the National Dairy Farm, Savar consisting of different blood lines to minimize the '**Inbreeding Depression**' upon inter-se mating to introduce the **ONBS** in dairy cattle development. Thus, efforts would be made to develop a primary base of rapid genetic progress of dairy cattle in Bangladesh using on-station '**Sibling Test**' procedure using "**BLUP**(Best Linear Unbiased Prediction) **Animal Model**" instead of '**Daughters' performance test**' in Field progeny testing to reduce the length of **generation interval**.

4. Expected outputs / benefits.

At the end of initial phase of successful technology development, this new technology could be extended in the field of animal breeding and reproduction in Bangladesh with a view to rapid increase in milk production. The potential benefits of the research work could be considered both as immediate and long term benefits in the field of animal breeding and reproduction of farm animals.

4.1. Immediate benefits.

Upon successful establishment of the technique, it might be possible to produce ET progeny of desired genetic merit both on Savar Dairy farm and at farmers level for more milk production in a relatively short period. Thus, it might be possible to develop the new option of ***Cellular Bio-techniques*** as a new intervention in the magnitude of animal reproduction as well as to bring the benefits of the techniques at farmers level.

4.2. Long term benefits.

Upon successful achievement of the objectives in first phase, research in the second phase would be extended to develop a comprehensive progeny testing program using Multiple Ovulation Embryo Transfer (MOET) in an Open Nucleus Breeding System(ONBS) to establish a "Superior Nuclus Breeding Herd" by utilizing the outcome of this research work. In MOET, proven sires and potential donors of desired genetic merit could be produced by 'Sib' selection method under controlled condition without excessive selection pressure, and thus, the generation interval could be reduced to 3.5 to 4 years only, unlike 6 to 7 years in conventional field progeny testing program. After the establishment of a Central Nucleus Herd of superior genetic merit in the National Dairy Farm, Savar, the benefits could be disseminated in the national population through existing AI network program using frozen semen produced from proven sires in the 'Nucleus Herd' for quick genetic improvement of dairy cattle in Bangladesh.

5. Indicator of Success.

The final success of the experiments would be the number of ET progeny of defined genetic merit produced to the corresponding number of recipients to harvest offspring per recipient upon delivery.

APPENDIX-1.

Outlines of 1st & 2nd phase of research

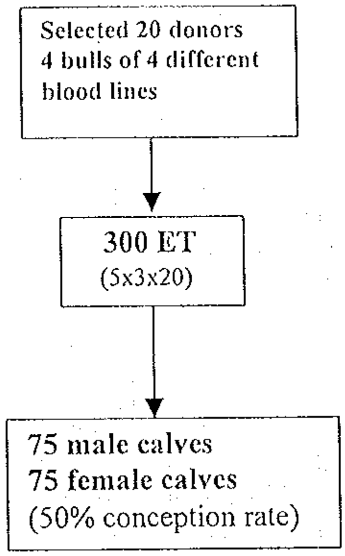

Fig-1. Development of Bio-techniques.

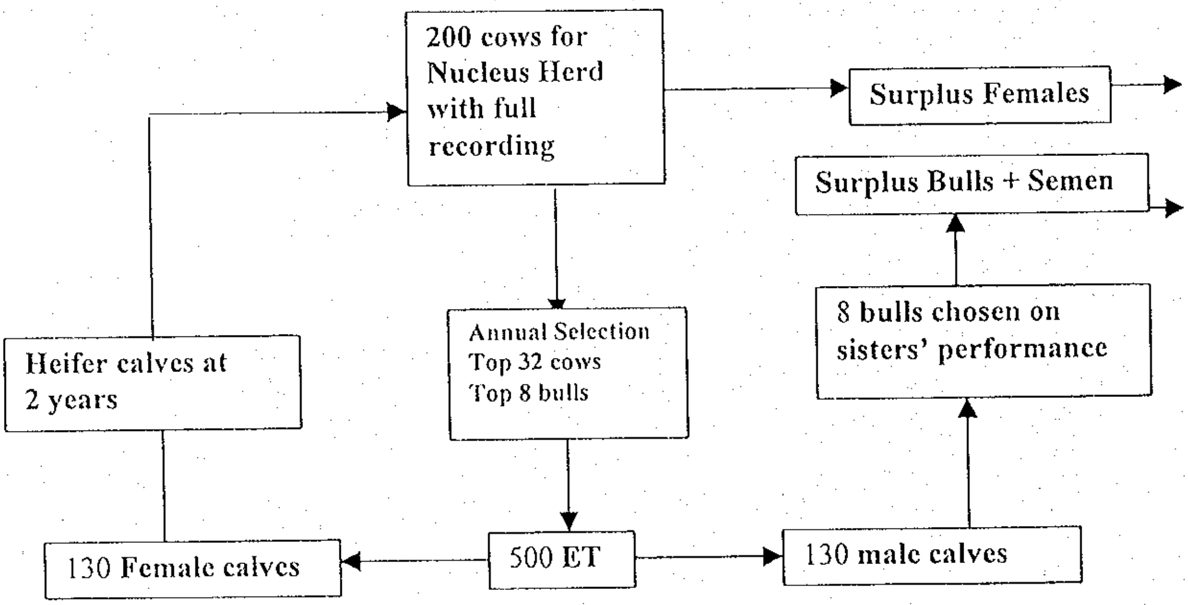

Fig. 2. Example of Open Nucleus Breeding System(ONBS) in Dairy Cattle.

The History and Present Situation of Livestock Industry in Japan

1. The History of Livestock Industry in Japan

According to the Japanese history of livestock farming, Japanese people were not in the habit of eating livestock before the Meiji Restoration (when Japan was opened to world trade about 130 years ago), due to the Buddhist prejudice against the taking of animal life. Cattle and horses were raised and used to haul carts or plow fields but not for food. The raising of livestock including pigs and chickens was not an industry.

In the Meiji Era (1868-1912), the government encouraged livestock breeding as a method of increasing agricultural products. Although some people raised milking cows, pigs, and chickens in the suburbs, this trend did not spread among general farmers, and the people did not eat livestock as popular food.

Following the stagnant agricultural industry of the early 1930s, livestock raising associated with farm management began to spread among farmers. The main purposes of livestock farming (cattle raising) were to lighten the effects of labor shortage in rural areas, to obtain farmyard manure, to use straw for livestock fodder and to increase farmers' income. Livestock raising was supplementary to rice cultivation. However, with the development of livestock farming, more farms began to raise cattle and horses as useful livestock for husbandry.

The amount of livestock reached its lowest level during the Second World War. With the people's changing diet after the War, the demand for livestock products increased. After the number of livestock farmers peaked in 1953, the amount of livestock declined with the advanced farm mechanization of using small agricultural machines.

At first, the amount of livestock per farm was very low and stock raising combined with rice-cultivation farming produced only low profits. However, in the days of high growth from the 1960s to the first half of the 1970s, the consumption of livestock products increased significantly, resulting in the dramatic expansion in their production.

The high economic growth increased the number of farmers with a side business, left out more small farmers, and expanded the scale of livestock raising amongst farmers without a side business. Although the number of livestock farms decreased, the amount of livestock steadily increased.

In these conditions, since the autumn of 1972, the price of various feeds has increased considerably because of the shortage in the supply of grain. In addition, the oil shock in the autumn of 1973 caused the prices of agricultural materials to soar. The demand for livestock products stagnated for some time reflecting the trend in consumption.

After the slump had been overcome, the Japanese economy resumed its rapid growth. The demand for livestock products continued to increase and the scale of livestock farming expanded. These conditions resulted in the overproduction of livestock products, with the exception of beef. Since the first half of the 1970s, eggs and milk have required constant production control. This has become a major policy task in the livestock industry.

Since 1982, Japan has had an increasing trade surplus and has had bilateral trade negotiations with the United States and Australia, and multilateral trade negotiations through GATT. As a result, the trade in beef has been liberalized since 1991 and in milk products since 1995. The number of livestock farmers has shown a

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marked decrease, which has caused a drop in the self-sufficiency rate.

Table I-1 Comparison of the Peak Number of Farms with the Present Number

Type	Peak	Present (Present/Peak)
Total	6,176,000 (1950)	3,443,550 (55.8 %) (1995)
Rice cultivation	4,885,000 (1965)	2,305,330 (47.2 %) (1995)
Dairy farming	417,000 (1963)	41,600 (10.0 %) (1996)
Beef cattle farming	2,319,000 (1956)	154,900 (6.7 %) (1996)
Pig farming	1,025,000 (1962)	16,000 (1.6 %) (1996)
Poultry farming	4,508,000 (1955)	10,400 (0.2 %) (1996)

2. Japanese Eating Habits and Consumption Trends

Backed by the increased national economy, Japanese food consumption has recently been increasing in quantity and variety. The total caloric intake per capita has not been more than 2,650 Kcal over the past 15 years, while the consumption of livestock products has shown a slow increase in the way of supplementing the decreased consumption of rice and sugar.

Between 1965 and 1994, the annual amount of food per capita showed the following changes in the style of food consumption: the amount of meat consumption (excluding whale meat) increased by 3.5 times, milk and milk products by 2.4 times, eggs by 1.6 times, oils and fats by 2.3 times, and fruit by 2.1 times. In contrast, the consumption of starchy foods including grains and potatoes decreased by about 25% and sugar by 50%. In recent years, that of vegetables also decreased by about 5% (Table I-2).

The amount of animal protein in the total protein consumption during the same period increased from 35% to 53%. The amount of livestock products consumed in the total animal protein consumption increased from 40% to 61%.

As the above figures show, the Japanese intake of carbohydrate in foods has decreased, while that of proteins has increased considerably. Nevertheless, the Japanese diet still includes more carbohydrates and fishery products than those of Westerners.

The annual grain consumption per capita in Japan is 100 kg, less than those in Korea, China, and Southeast Asian countries, where people live on rice. However, this amount is 1.5 times that of the United States and 2.0 times that of Australia.

The annual animal protein consumption per capita in Japan includes far more fishery products than those in other countries. The amount of consumption of eggs stands at the top level. The amount of meat consumption, however, is half of that of the UK, one third of those of France and Denmark, and a quarter of that of the United States. The amount of milk products consumed is half of that of Italy, one third of that of the United States, and a quarter of that of Denmark.

3. Situation of Livestock Farming in Japanese Agriculture

In Japanese agriculture, rice cultivation has traditionally been predominant. Livestock farming has expanded its shares from a low of 21% in 1965 to a little less than 30% in the 1980s, in second place, slightly below rice cultivation.

In recent years, the proportion of vegetable farming has expanded, approaching that of livestock farming (Table I-2).

Trends in livestock raising by species of animals during the last 30 years show that the number of livestock farms has markedly decreased but the number of the animals has remained at almost the same level. Therefore, the scale of raising has noticeably expanded.

Since the import liberalization of beef in 1991, the number of cattle has decreased. The number of smaller animals such as pigs and chickens has decreased as well (Table I-3).

Table 1-2 Changes in the Amount of Agricultural Production

	Section \ Fiscal year	1965	1970	1975	1980	1985	1990	1994 (prompt report)
Actual figures(100 million Yen)	Amount of total production	31,769	46,643	90,514	102,625	116,205	14,927	112,691
	Planting and sowing	24,161	34,206	65,012	69,660	82,996	82,952	85,655
	Rice	13,691	17,662	84,658	30,781	38,299	31,950	36,716
	Wheat	940	483	566	1,661	2,152	1,698	1,177
	Potatoes	793	781	1,277	2,088	2,031	2,388	2,640
	Pulse and Peas	518	578	771	995	1,041	929	829
	Vegetables	3,744	7,400	14,673	19,037	21,104	25,880	24,874
	Fruits	2,100	3,966	6,462	6,916	9,388	10,451	11,544
	Sericulture	727	1,261	1,463	1,510	845	466	123
	Livestock farming	6,628	10,835	23,403	30,677	31,6876	30,836	26,178
	Dairy cow	1,461	2,834	4,655	8,086	8,876	8,055	8,116
	Raw milk	1,169	12,333	4,648	6,715	7,596	7,634	7,158
	Beef cattle	754	974	2,467	3,705	4,727	5,981	4,680
	Pigs	1,412	2,538	7,833	8,334	7,910	6,314	5,495
	Fowl	2,270	8,062	4,776	5,748	5,099	4,778	38,25
	Hen eggs	2,270	8,062	4,776	5,748	5,099	4,778	3,825
	Income from agricultural production	18,982	26,293	52,054	45,839	43,800	48,172	50,695
Component ration (%)	Amount of total production	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Planting and sowing	76.1	73.4	71.8	67.6	71.4	72.2	76.0
	Rice	43.1	37.9	38.3	30.1	32.9	27.8	32.6
	Wheat	3.0	1.0	0.6	1.6	1.9	1.5	1.0
	Potatoes	2.5	1.74	1.4	2.0	1.7	2.1	2.3
	Pulse and Peas	1.6	1.2	0.8	0.9	0.9	0.8	0.7
	Vegetables	11.8	15.7	16.2	18.5	18.1	22.5	22.4
	Fruits	6.6	8.5	7.1	6.7	8.1	9.1	8.5
	Sericulture	2.3	2.7	1.6	1.5	0.7	0.4	0.1
	Livestock farming	20.9	23.2	25.9	29.9	27.2	26.8	23.2
	Dairy cow	4.6	6.1	6.3	7.9	7.6	7.9	7.2
	Raw milk	3.7	5.0	5.2	6.6	6.5	6.6	6.4
	Beef cattle	2.4	2.2	2.4	3.6	4.1	5.2	4.2
	Pigs	4.4	5.4	8.1	8.1	6.8	5.5	4.9
	Fowl	8.7	8.9	8.3	9.5	8.0	7.5	6.4
	Hen eggs	7.1	6.6	5.3	5.6	4.4	4.2	3.4
	Income from agricultural production	59.8	56.4	57.5	44.7	37.7	41.9	45.0

Reference: "Statistics on Income from Agricultural Production." MAFF

Notes: 1.Figures on and before 1975 do not include Okinawa Prefecture.

2.Component ratio for income from agricultural production corresponds to the percentage of income from agicultura production.

3

Table1-3 Changes in the Number of Livestock Farms and Number of Animals (1)

(Thousands of farm households; thousands of head)

ITEM / YEAR	Dairy cows		Beef cattle		Pigs	
	Number of farming households	Number of head households	Number of farming	Number of head	Number of farming households	Number of head
1965	(100) 382	(100) 1,289	(100) 1,435	(100) 1,886	(100) 702	(100) 3,976
1975	160	1,787	474	1,857	223	7,684
1985	82	2,111	298	2,587	83	10,718
1995	44	1,951	170	2,965	19	10,250
1995/65	(12)	(151)	(12)	(157)	(3)	(258)

Source: "Livestock Industry Statistics,"MAFF.

Table1-3 Changes in the Number of Poultry Farms and Number of Fowls (2)

(Thousands of farm households; thousands of fowls)

ITEM / YEAR	Layers		Broilers	
	Number of farming households	Number of fowls	Number of farming households	Number of fowls
1965	(100) 3,243	(100) 120,197	(100) 20	(100) 18,279
1975	510	154,504	12	18,279
1985	124	177,477	7	150,215
1995	8	193,854	4	119,682
1995/65	(0.2)	(161)	(20)	(655)

Source: "Livestock Industry Statistics," MAFF.

eanwhile, improved management of breeding technology and advanced mechanization have made large-scale breeding possible. Feeding, milking, and egg collecting have been mechanized and the construction of free-stall cowhouses and excrement disposal facilities have increased partly as a result of government subsidies.

However, overwork and environmental problems have been raised. The condition has needed time for relaxation. To deal with the problems, the automation of work has been promoted and a helper system has been available.

In addition, to address internationalization, further reduction in production costs has been demanded. However, under such conditions, dairy farmers can secure their successors much more than those engaged in other types of farming.

4. Supply and Demand in the Market of Major Milk Products

The supply and demand of meat, milk and milk products, and hen eggs over the past 29 years are shown in Table 1-4.

Meat

The amount of pork consumption (39% of the total meat amount) is the largest, followed by chicken and beef. This order has not changed for some time. The increase in the rate of consumption of each type of meat has been headed by chicken (by 8.14 times between 1965 and 1994) followed by beef (by 6.25 times) and pork (by 5.15 times).

Following the import liberalization of beef in 1991, the retail price of beef falls drown and the growth rate of consumption is increasing, particularly in recent years.

During the period a large amount of horsemeat and sheepment categorized under "other meats" was imported to be used in the production of processed meat, partly because of the liberalization of these items. Horse meat and sheepment, categorized under "other meat', were used in large quantities for processed meat products early in the period of high economic growth when demand for meat rose sharply because it became a free trade item. Demand dropped substantially, however, as disposable income grew and tastes diversified.

Ttable1-4 Supply and Demand of Main Livestock prouducts

(Thousands of tons)

Fiscal years	Beef	Pork	Chicken	Other meat	Meat total	Milk and milk products	Hen eggs
1965							
Domestic production	216	407	204	22	850	3,271	1,330
Exports	-	-	-	-	-	-	-
Imports	15	-	6	126	148	506	2
Domestic consumption	231	407	210	148	998	3,815	1,332
Percentage of total meat consumption	(23)	(41)	(21)	(15)	(100)		
1975							
Domestic production	353	1,040	740	6	2,137	5,008	1,807
Exports	-	-	3	-	3	-	-
Imports	64	178	22	328	591	1,016	55
Domestic consumption	417	1,218	758	333	2,726	6,160	1,862
Percentage of total meat consumption	(15)	(45)	(28)	(12)	(100)		
1994 (figures rounded off)							
Domestic production	602	1,390	1,258	8	3,259	8,387	2,577
Exports	-	-	3	-	3	-	-
Imports	842	704	455	110	2,111	2,732	104
Domestic consumption	1,444	2,095	1,709	118	5,366	11,481	2,681
Percentage of total meat consumption	(27)	(39)	(320)	(20)	(100)	-	-
Rated of growth of consumption ('94/'65)	625	515	814	80	538	301	201

Source: "Food Balance Sheet" MAFF

Notes: 1. Other meat includes sheep, horse, and rabbit meat.

2. The volume of meat is in terms of dressed weight; milk products are in terms of raw milk; and eggs are in terms of unshelled eggs.

Milk and milk products

In 1979, producers' organization implemensted a planned production system and since then the production milk has been mointained at a regulated level. The production of raw milk reached an annual level of 7 million tons in 1983 and increasing 8 million tons in 1989. The majority of imported milk products shown in the Food Balance Sheet refers to natural cheese on a milk equvlent basis (imports for direct consumption and raw materials for the production of processed cheese). Since the establishment of the "the Temporary law on deficiency paymendts or Manufacturing milk productcers (1965)", the Livestock Industry Promotion Corporation has imported milk products, which was classified the state trading items, as the occasion arises to suit supply and demand.

However, in response to the results of acceptance the agriculture negotiations agrceement according to GATT on the Uruguay Round held in December 1993, tariffication of milk products weare implemented in 1995.

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5. Preservation of Environment in Livestock Farming

(1) Outline of environmental regulations

The laws for the preservation of the environment, such as the Law on the Disposal of Wastes and Cleaning, the Water Pollution Prevention Act, and the Malodor Prevention Act, control wastes, waste water, malodors, and other materials emitted from places of work. These laws apply to livestock farming. The law provides that farmers shall be responsible for the proper disposal of livestock excreta and shall employ methods, such as treatment through fermentation, which are unlikely to damage people's living environment. To prevent water pollution in public water areas, the establishment of cattle sheds on more than a given scale must be reported to the authorities and are obliged to obey the standards for discharge. In areas where the observation of the standards alone is insufficient for the conservation of water, stricter regulations are provided.

(2) Utilization and treatment of livestock excreta

In order to promote livestock farming in harmony with the sound development of livestock management, maintenance and improvement of fertility, local societies, and the natural environment, it is an essential task to appropriately address environmental problems. Livestock farmers not only observe the environmental regulations but also adequately treat and utilize livestock excreta mainly by using it on farmland and grassland to recycle it as a resource. In this case, farmers generally employ the method in which after excretion has been divided into feces and urine, feces is used as compost, and urine is processed into liquefied manure or disposed of through waste water treatment facilities. Japanese farming management is classified as either crop cultivation or livestock breeding. Many farmers specialize in one type but an area as a whole has promoted environmental-preservation-directed agriculture by, for example, recycling livestock excreta.

6. Long-term Prospects for the Demand and Production of Livestock Products in Japan

The Demand and Supply Forecost Sub Committee of the Agricultural Administration Council, which is on advisory organization to the Minister of Agriculture, Forestry and Fishery anounced estimates supply and demand. This subcommittee announced on December 26,1995 .The Long-term Prospects for the Demand and Production of Agricultural Product ,(decided upon by the Cabinet on the same day). The target year for these prospects is fiscal 2005, with fiscal 1993 though 1994 as the basic years. The outline of its livestock product section will be introduced in the following .

(1) The long-term prospects for the demand and production of meat are shown in Table 1-5.

(2) The long-term forecast for the demand and production of milk and milk products is shown in Table 1-6.

Among them, let us analyzed beef because of its particularly high increase in demand.

Total demand for beef (dressed weight) is increasing at the rate of 2.5 to 3.9 % a year and is expected to reach 1.82 to 2.14 million tons compared to 1.22 million tons of the base fiscal year.

With regard to production, an increase at the annual rate of 2.5% is expected under the aim of the policy to increase the meat resources while promoting a stronger management disposition, expansion of self-sufficient roughage base and utilization of embryo transplant for an increase to 0.8 million tons (560,000 tons in dressed meat) as opposed to 0.6 million tons of the base fiscal year.

As for total number of beef cattle raised, 2.96 million heads in the base fiscal year is expected to increase by 1.46 times to 4.33 million heads in the fiscal year 2005.

The prospects on the volume of imported beef is that it will continue to increase at an annual rate of 2.6 to 5.0% from 0.75 million tons in the base fiscal year (525,000 tons in dressed meat, same rule applies hereafter) and reach 1.02 million tons to 1.34 million tons (714,000 tons to 938,000) in the fiscal year 2005.

As a result, self-sufficiency rate of beef will drop from 49 to 44% to44 to 37%

(3) As for livestock farming, the production is expected to increase through the consolidation of management structure on an adequate scale based on a maintained work force, managerial ability and the expansion of feed bases.

Thus the scale of the demand and supply for beef is predicted to expand for some time in the future, however, the scale of the Japanese intake of foods will not keep pace with the expansion of demand and supply at the same time. The per capita daily supply of calories has been stable since the 1980s when the value exceeded approximately 2,600 Kcal. Accordingly, the increase in the demand for beef is likely to balance the decrease in the demand for rice and the smaller increase in the demand for other food.

In Japan, people have continued to eat a Japanese-style dietary patterns that is nutritiously well-balanced and realization of diet that will contributed to health life.

In recent years, however, the consumption of carbohydrates has been approaching the minimal level, while that of fat is nearing the maximal level. Well-balanced nutrition and safe foods will be further demanded to maintain a healthy life style in the future.

Table 1-5 Meats

Classification			Fy 1992	Fy 1993	Fy 2005	Rate of increase ordecrease (%) 2005/1993
Meat total	Total demand	(million tons)	5.22	5.30	6.05 to 6.45	114 to 122
	production volume	(million tons)	3.40	3.37	3.67	109
	Self-sufficiency rate	(%)	65.1	63.6	60.1 to 56.5	-
	Annual net food per person	(kg)	29.2	29.9	23.0 to 35.0	110 to 117
Beef	Total demand	(million tons)	1.22	1.35	1.82 to 2.14	135 to 159
	Production volume	(million tons)	0.60	0.60	0.80	133
	Total number of heads raised	(million heads)	2.96	2.97	4.33	146
	Self-sufficiency rate	(%)	49.2	44.4	44.0 to 37.4	
	Annual net food per person	(kg)	6.7	7.4	9.6 to 11.0	130 to 149
Pork	Total demand	(million tons)	2.09	2.08	2.16 to 2.20	104 to 106
	Production volume	(million tons)	1.43	1.44	1.45	101
	Total number of heads raised	(million heads)	10.78	10.62	10.31	967
	Self-sufficiency rate	(%)	68.4	69.2	67.1 to 65.9	-
	Annual net food per person	(kg)	11.5	11.4	11.0 to 12.0	96 to 105
Chicken	Total demand	(million tons)	1.76	1.72	1.93 to 2.00	112 to 116
	Production volume	(million tons)	1.37	1.33	1.41	106
	Total number of heads raised	(million heads)	1.35	1.27	1.31	103
	Self-sufficiency rate	(%)	77.8	77.3	73.1 to 70.5	-
	Annual net food per person	(kg)	10.6	10.4	11.0 to 12.0	106 to 115

Table 1-6 Milk and Milk Products

Classification		Fy 1992	Fy 1993	Fy 2005	Rate of increase ordecrease (%) 2005/1993
Total demand	(million tons)	10.70	10.74	12.59 to 13.63	117 to 127
Production volume	(million tons)	8.62	8.55	10.10	118
Total number of heads raised	(million head)	2.07	2.02	1.98	98
Self-sufficiency rate	(%)	80.6	79.6	80.2 to 74.1	-
Annual net food per person	(kg)	83.6	83.6	95.0 to 103	114 to 123

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7. Export and Import of Livestock Products

(1) Liberalization of livestock products

Japan participated in GATT in 1955 and OECD in 1964. As one of the developed countries, the nation has secured an advantageous position for its domestic economy in international society by promoting trade liberalization and the export of industrial products such as automobiles, machines, and electrical goods. In the field of agriculture, although the country imports many resources including concentrated feed and fertilizer materials, it stands at a disadvantage in respect of production costs such as land rent and personnel expenses. Also, with respect to livestock farming, the country has been compelled to liberalize its products under foreign and domestic pressure.

Natural cheese was liberalized in 1951, chicken meat in 1962, and sausages, cattle, pigs and pork in 1971. Since then, through international negotiations, more intensively processed products have liberalized. Finally beef was finally liberalized in 1991 and milk products in 1995.

To address internationalization, the scale of livestock farming has been further expanded and the number of livestock farmers, particularly medium-sized and small ones, has decreased partly because of the shortage of successors to the business. In such conditions, although imports were limited to the amount of shortage of domestic products, many livestock products have recently been imported to meet the demand in Japan.

(2) Import of livestock products

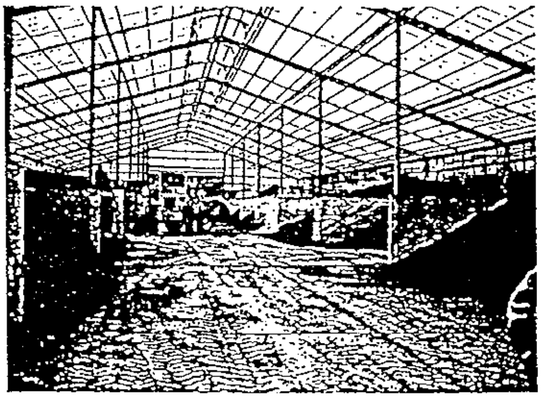
The top 20 agricultural items imported to Japan include corn for feed, beef, pork, chicken, wool, and cattle hide.

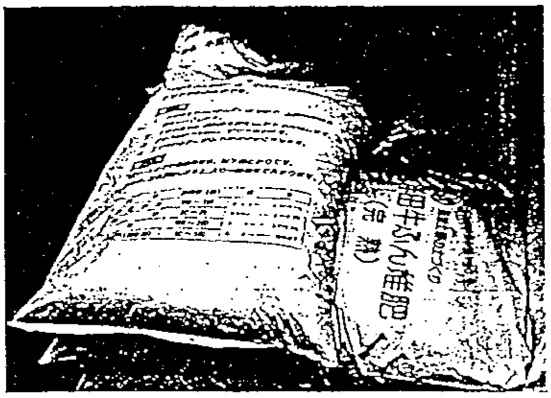
The trade statistics for FY 1995 shows that 658,000 tons of beef was imported with 39% self-sufficiency, 535,000 tons of pork with 64% self-sufficiency, 542,000 tons of chicken with 70% self-sufficiency, 104,000 tons of eggs with 96% self-sufficiency, and approximately 3 millon ton of milk products with 70% self-sofficiency.

(3) Export of livestock products

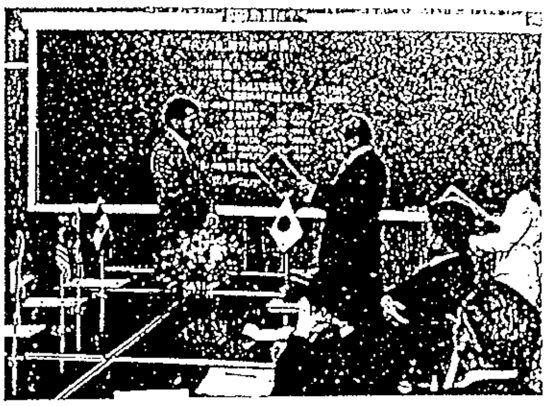
Japan does not export many livestock products. Since 1988 when the liberalization of beef was decided, three meat centers (in the prefectures of Kagoshima, Miyazaki, and Gunma) have been rearranged and the sanitary conditions improved to prepare for the export of high-grade Japanese beef with "sashi" that is maribiling fat to the United States and other countries. A total of 42.267 kg of beef was exported in 1995.

Chickens and drumsticks (momiji) have been exported, mainly to Hong Kong, and pigskin to Italy and Korea. Intensively processed powdered milk prepared for infant has been exported to the Middle and Near East and Southeast Asia.





The Present State of Technical Cooperation



In recent years, interdependence among nations has been deepened, and the prosperity and stability of the world depends on harmonious development of the international community.

Many developing countries are still faced with various socio-economic difficulties such as poverty, food shortages, and external debt accumulation. It is unlikely that developing countries will be able to address such problems by themselves. Therefore, developed countries have a common mandate to support autonomous economic development in developing countries.

Japan has been trying to support socio-economic development and improvement in the standard of living in developing countries in proportion with its elevated position in the international community. To realize such objectives Japan has set a series of medium-term targets for ODA since 1978. As a result, Japan has been the largest donor among DAC countries for four consecutive years. There is not doubt that the impact of Japan's technical cooperation and Japan's responsibility are both huge.

1. History of livestock technical cooperation

Looking back at Japan's technical cooperation in agriculture, forestry, and fisheries after WWII, it is clear that the cooperation began in the form of grant aid in connection with war reparations. Prompted by its joining of the Colombo Plan in 1954, Japan started to take a systematic approach in aid, resulting in the establishment of the Overseas Technical Cooperation Agency (OTCA) in 1962. The basic method of Japan's cooperation was established with the start of technical cooperation by means of projects in 1967. At that time, Japan was emerging as an economic power and there were growing needs for Japan's cooperation with respect to developing countries. Against the backdrop of such moves, the Japan International Cooperation Agency (JICA) was established in 1974. Since then, this aid system has been developing steadily to date.

Technical cooperation in livestock production and animal health started in the mid to late 1940's with the contribution to the eradication of Rinder Pest in developing countries through the use of a Rinder Pest vaccine as part of an FAO project. This vaccine was developed in Korea during World War Two by the late Dr. Junji Nakamura, Director of the former Japan Biology Research Institute.

The first example of project-type technical cooperation in livestock was a large-scale cooperation program called the Japan-Cambodia Friendship Livestock Center that started in 1959.

This project was a comprehensive program for experiments and research to enhance livestock production technology, demonstration of successful examples, and training technical experts by breeding Japanese beef cattle, pigs, and chickens in Cambodia. This project continued for over 11 years until a coup d'etat in 1970, when all the Japanese experts were forced to leave the country. During this period, a total of about 30 young livestock technologists and veterinarians gained precious experiences there. These experts are now leaders or retirees of administrative institutions or organizations that are related to livestock technology. They constitute a group of experts that has directly or indirectly contributed to virtually all development of technical cooperation in livestock to date.

Following the establishment of JICA, there was a growing interest in international cooperation projects in connection with development import plans against the backdrop of the prevalent fear of a world food crisis at that time. Accordingly, project-type technical cooperation started on a full scale. Between 1977 and 1978,

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a number of projects were launched; including: Animal Health Improvement Projects in Thailand and Indonesia, Northern Madagascar Livestock Development Project, which centered on breeding beef cattle, and a Pig/chicken Raising Development Project in what was then Burma (now called Myanmar).

Since 1980, technical cooperation has diversified in terms of aid sectors and geographical distribution. Japan is actively providing technical aid to Latin America, Africa, and China, as well as ASEAN countries.

2. The outline of technical cooperation

Technical cooperation consists of the following elements.

(1) Dispatch of experts

Experts are dispatched individually or as part of a project-type technical cooperation program. Dispatched experts provide guidance and advice in various specialized fields at governmental institutions or experiment/research facilities of the recipient countries. In addition, dispatch of study teams for development is aimed at conducting field surveys and providing training in relation to formulation of development projects in developing countries.

(2) Reception of trainees

Reception of trainees can roughly be divided into group training and individual training.

Group training is provided according to prearranged training courses aimed at satisfying common needs of developing countries. Individual training covers project-type technical cooperation and individual needs.

(3) Provision of equipment

When integrated with the dispatch of experts, provision of equipment further enhances the effectiveness of cooperation. Additionally, equipment is sometimes provided individually as an independent project.

(4) Project-type technical cooperation

Project-type technical cooperation is aimed at transferring and promoting technology for technical experts of recipient countries in cooperation with development projects there. When reception of trainees, dispatch of experts, and provision of equipment into one project, planning, implementation, and evaluation of a project are carried out systematically and comprehensively, thus facilitating effective transfer of technology.

(5) Training in third and second countries

After selecting a country from a developing region with common social, cultural, and linguistic backgrounds, Japan helps the selected country to accept trainees from neighboring countries in the region (third countries) or from within that country (second country) so as to transfer technology. The management method employed is basically the same as that of project-type technical cooperation. In other words, Japan dispatches experts (lecturers) and bears training expenses.

(6) Study for development

Study for development is aimed at adequate formulation of a comprehensive project that plays an important role in socio-economic development in developing countries such as agricultural infrastructure, electric power facilities, communications facilities and roads. With Japan's cooperation, such study covers preliminary survey for considering the technical and economic feasibility of study and a subsequent project, as well as formulation of a report on these results. There is a good chance that the results of this study will develop into new cooperation in the form of grant aid or yen loans.

(7) Dispatch of Japan Overseas Cooperation Volunteers (JOCV)

Japan Overseas Cooperation Volunteers is a governmental program that support voluntary activities by young Japanese people who contribute to socio-economic development of developing countries. This program is aimed at providing cooperation in close relation with the local community while living with people of a recipient country.

3. The State of Livestock Technical Cooperation

(1) Group training

Reception of trainees for group training in livestock started in 1962, when animal health study courses were established at the National Institute of Animal Health. Since then, national livestock breeding stations and some universities have been providing group training. At present, all livestock-related group training courses are offered at the National Livestock Breeding Center, except for dairy farming promotion and examination technology courses provided at Obihiro Zootechnical University. In accordance with reorganization of national livestock breeding stations in October 1990, the National Livestock Breeding Center has singled out overseas technical cooperation as one of its major duties. The Center has set up an overseas cooperation division and overseas technical cooperation officers, and has built new facilities for this purpose. The following six courses are currently offered at the Center:

(i) Poultry production and breeding technology course

(ii) Embryo Transfer for cattle course

(iii) Twinning and In vitro fertilization technology for cattle course

(iv) Breeding and artificial insemination in cattle course

(v) Swine production and breeding technology course

(vi) Feed production and utilization technology for ruminant animal course

(2) Training in third countries

Training in third countries has been provided in Asia for those involved in animal health at: Foot-and-mouth Disease Center in Thailand, Animal Health Center and Veterinary Assay Laboratory in Indonesia, and ASEAN Poultry Diseases Training Center in Malaysia.

(3) Dispatch of experts

Experts are dispatched individually or as part of a project-type technical cooperation program.

With regard to individual dispatch, experts are sent according to requests from the governments of developing countries on a individual basis. Such experts provide guidance and advice in various specialized fields at governmental institutions or experiment/research facilities of the recipient countries.

In the case of project-type technical cooperation program, experts are dispatched based on an agreement between Japan and the recipient country. These experts try to achieve objectives of a project according to their specialties.

(4) Dispatch of study teams

To date, many experts have been dispatched in various study teams organized by JICA. Apart from this, the Livestock Industry Bureau dispatches livestock study teams to Asian countries so as to determine new cooperation needs and provide training through the Japan Livestock Technology Association as part of projects covered by the ODA budget.

(5) Dispatch of Japan Overseas Cooperation Volunteers (JOCV)

Livestock technology cooperation projects by JOCV are slightly different in nature from other projects. This is because the JOCV programs are independent voluntary activities, although they are under the jurisdiction of JICA. Livestock technology cooperation accounts for one-fifth of the field of agriculture, forestry, and fisheries in terms of number of volunteers dispatched. Volunteers specialized in livestock technology are scattered across the world. In terms of specialty, livestock breeding and veterinary medicine account for about 40% each. The other specialties include poultry farming, feed crops, beekeeping, and livestock product processing.

JOCV has played a central role in Japan's livestock technology cooperation in African countries, Bangladesh, and the Philippines.

It is important to utilize the energy of such JOCV volunteers for upgrading livestock technology cooperation. JOCV is trying to create a system for utilizing experience and information it gained in developing countries by interviewing ex-JOCV volunteers, and accumulating and arranging such information for future use. This would also provide another opportunity for ex-JOCV volunteers to be dispatched as experts.

(6) Project-type technical cooperation

Project-type technical cooperation also plays a central role in livestock field.

As of the end of 1993, there were 82 projects in the field of agriculture, forestry, and fisheries, of which Livestock accounted for 13%, or 13 projects.

Of all the projects completed so far, those in animal health, which center on production of foot-and-mouth disease vaccine and epidemic prevention, account for half. This is no longer true; at present, projects are more diversified. Besides animal health projects, an increasing number of projects are carried out in livestock improvement, reproduction, dairy product processing technology, feed crop production/utilization technology.

Animal health remains an important field that needs Japan's cooperation. This field is the top priority in livestock technology cooperation for developing countries suffering from low productivity due to animal epidemics. Accordingly, cooperation in animal health started in an early stage of Japan's international cooperation. Japan has greatly contributed in this field, especially in the ASEAN region. Animal health will remain important to least less developing countries (LLDC). Even in developing countries where animal health conditions have been remarkably improved, the problem of low productivity due to chronic disease is still an important issue.

Yet, judging from changes in livestock project-type cooperation to date, it seems that cooperation in animal health, the most basic field, has already passed its peak. In recent years there has been increased demand for a more complicated field: transfer of livestock production technology.

4. Problems and prospects of livestock technology cooperation

The mid to long-term supply and demand situation of world food is expected to be tight due to a massive population increase and expanding demand for foods, especially feed grains, driven by enhanced standards of food consumption in developing countries. Requests for Japan's cooperation in livestock are expected to increase. Japan needs to cope with such requests appropriately.

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Table IX-1 Outline of Livestock Technology Cooperation Projects

As of September 12, 1996

Project name	Period		Institutions (locations)	Details	Remaining problems and/or future plans
China Tianjin Dairy Farming Development Project	5 years R/D, 2 years F/U	March 1, 1990 - February 28, 1997	• Tianjin Cows Breeding Improvement Center • Baodi Xian National Huanzhuang Farm (Jiangxi ward, Tianjin: 150 km from Beijing)	Cow Breeding Improvement Center • Betterment of cow improvement method (F/U) • Improvement of cow raising/management technology including health and nutrition (F/U) • Establishment of production technology for frozen semen, or Straw Method (completed) • Introduction of Embryo Transfer technology for cows (completed)	(1) Cow Breeding Improvement Center • Maintenance and data utilization of milking capacity examination program • Survey method of linear examination and utilization of the results • Raising/management technology of cows with high milking capacity (2) Baodi Xian National Huanzhuang Farm Technology for efficiently using feed, including unused resources, to complement vulnerable feed infrastructure
Honduras Pig Raising Development Project	5 years	May 15, 1993 - May 14, 1998	National Agricultural School, the Ministry of Natural Resources (Catacamas, Oracho: 240 km from Tegucigalpa)	(1) Introduction of high capacity boars/sows for breeding and production and supply on an experimental basis. (2) Development and improvement of pig raising technology (raising management, reproduction, breeding, health, etc.) (3) Display of a demonstrative model of appropriate raising management and technical guidance for pig raisers. (4) Training related to (1), (2) and (3) mentioned above.	(1) Decision on where to distribute young pigs. (2) Forage crop production and establishment of its method of utilization. (3) Technology transfer of raising management for improved pigs. (4) Holding of training sessions by C/P and establishment of WID promotion system.
Central Thailand Dairy Farming Development Project	5 years R/D	August 1, 1993 - July 31, 1998	• The Bureau of Livestock Promotion, the Ministry of Agricultural cooperative Batmahlani AI Center (30 km north of Bangkok) • The Bureau of Cooperative Promotion, the Ministry of Agricultural Cooperative Chai Badan Dairy Farming Display Center (200 km north of Bangkok)	• Improvement of customary dairy farming technology • Training on, and demonstrative display of, improved diary farming technology for government officials, dairy farming technical staff, and core dairy farmers	(1) Immediate measures to produce high-quality frozen semen (2) Stable procurement of good-quality forage crop (3) Full-time positions for counterparts
China Inner Mongolia Dairy Products Processing Technology Improvement Project	5 years R/D	June 1, 1994 - May 31, 1999	• Inner Mongolia Agriculture and Dairy Farming Academy within the Education Agency (Hohhot: 670 km west of Beijing)	• Collection, separation, fixation, and preservation of microorganisms useful for ethnic dairy products • Production, hygiene, and quality control of basic dairy products • Production, hygiene, and quality control of basic dairy products (milk, condensed milk, ice cream, butter)	(1) It is difficult to secure the construction funds for a dairy products microorganism experiment building. (2) Shortage of raw milk
China Hebei Province Feed Crop Production/Utilization Technology Improvement Project	5 years R/D	April 1, 1995 - March 31, 2000	• Zhoushi Agriculture and Forestry Academy • Zhoushi Stock Farming and Fisheries Bureau (Zhousi: 250 km south-southwest of Beijing)	• Introduction of appropriate species for feed crops (adaptability examination) • Feed crops cultivation examination (cultivation and fertilization technology) • Harvest, preparation and use of feed crops (harvesting and preparation technology, feed analyzing method) • Grassland improvement (grassland improvement planning method, grass improvement technology)	(1) Provision of necessary equipment (2) Preparation of a research room, laboratory and its incidental equipment, an experiment field, demonstration farm.

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Project name		Period	Institutions (locations)	Details	Remaining problems and/or future plans
Bolivia Beef Cattle Improvement Project		July 1, 1996 -	* Beef Cattle Improvement Center (main site) (60 km north of Santa Cruz) * Beni Technical College (sub site) (550 km north of Santa Cruz)	(1) Breeding improvement a) Fact-finding survey, b) propagation of improvement methods, c) transfer of aggregate direct examination method, d) promotion of good-quality breeding stock registration, and e) training (2) Embryo Transfer/reproductive health control a) Fact-finding survey, b) Embryo Transfer technology, c) transfer of reproductive health control technology, and d) training (3) Raising management a) Fact-finding survey, b) demonstration of rational grazing management technology, c) transfer of fattening technology, and d) training (4) Grassland and feed crops a) Fact-finding survey, b) transfer of grazing land management method, c) transfer of forage crop preservation method, and d) training	(1) Transfer and promotion of breeding improvement technology for beef cattle (mainly nellore breed) (2) Development and promotion of comprehensive raising technology necessary to utilize highly-productive beef cattle (3) Improvement of the health control system (4) Improvement in technology of grassland development, maintenance, and grazing suitable for the environment in Bolivia. (5) Introduction of technology of a production and preservation (silage, etc.)
Uruguay Veterinary Research Institute Reinforcement Project	5 years R/D	October 1, 1996 - September 30, 2001	* Head Office of Livestock Service, the Ministry of Agriculture, Livestock Farming and Fisheries. * Animal Health Research Bureau "Miguel C. Rubino" Head Office of Livestock Service	Improvement of veterinary diagnostic technology for detecting livestock epidemics promptly and accurately. * Pathology, bacteriology and virology Technology transfer for the improvement of diagnostic technology concerning livestock epidemics * Test animals Transfer of production technology of small animals for diagnosis concerning the aforementioned fields, and establishment of such a production system	(1) Inadequate research system for diagnosis of livestock epidemics (2) Lack of manpower, such as researchers
Indonesia Dairy Farming Technology Improvement Project	5 years	March 3, 1997 - March 2, 2002	* Production Bureau, the Head Office of Livestock Industry, the Ministry of Agriculture * Western Java State Livestock Industry Bureau * Cianjur Dairy Farming Center * Cikore Dairy Farming Center	Improvement of dairy farming technology at farmers' level * Management raising of cows * Reproductive health control * Production and use of forage crop * Quality control of milk	(1) Low productivity of cows in Western Java (2) Lack of skills of farmers' leaders (promoters) (3) Low level of hygiene and quality control for milk

Livestock Industry Bureau

- Director-General
  - Councillor
    - Counsellor
  - Administration Division
    - Office of Livestock Industry Policy Planning
    - Office of Livestock Industry Promotion
  - Livestock Farming Division
    - Office of Livestock Industry Environment Policy
  - Milk and Dairy Products Division
  - Meat and Egg Division
  - Animal Production Division
    - Office of Animal Production Technology
  - Commercial Feed Division
  - Forage Crop Division
    - Office of Grassland Development Promotion
  - Animal Health Division
    - Office of Veterinary Drug Administration
  - Horse Race Supervision Division

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Attached Organization

National Livestock Breeding Center

- Niikappu Ranch
- Tokachi Ranch
- Ohu Ranch
- Iwate Ranch
- Ibaraki Ranch
- Nagano Ranch
- Okazaki Ranch
- Hyougo Ranch
- Tottori Ranch
- Kumamoto Ranch
- Miyazaki Ranch

Animal Quarantine Station

- Narita Office
- Nagoya Office
- Kobe Office
- Moji Office
- Okinawa Office

National Veterinary Assay Laboratory

Agriculture, Forestry and Fisheries Research Council (Relating to Livestock Industry)

Research Facilities

- National Institute of Animal Industry
- National Institute of Animal Health
- National Grassland Research Institute

Nation Agricultural Experiment Station (Relating to Livestock Industry)

- Hokkaido National Agricultural Experiment Station
- Tohoku National Agricultural Experiment Station
- Hokuriku National Agricultural Experiment Station
- Chugoku National Agricultural Experiment Station
- Kyushu National Agricultural Experiment Station

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Table 1 Change of Livestock farms and livestocks in Japan

		1970	1980	1990	1996	1997
Dairy Cattle	farms (thousands)	308	106	63	41	39
	dairy cattle (thousands)	1,804	2,104	2,058	1,903	1,875
	number of dairy cattles per farm (heads)	6	20	33	46	48
Beef Cattle	farms (thousands)	902	353	232	154	142
	beef cattle (thousands)	1,789	2,281	2,702	2,862	2,814
	number of beef cattles per farm (heads)	2	4	12	19	20
Pig	farms (thousands)	445	127	43	16	14
	pigs (thousands)	6,335	10,065	11,816	9,845	9,759
	number of pigs per farm (heads)	14	79	272	615	704
Broiler	farms (thousands)	18	8	6	4	
	broiler (millions)	54	131	150	600	
	number of broiler per farm (thousands)	3	16	27	146	
Layer	farms (thousands)	1,703	188	87	7	6
	layer (millions)	169	164	187	145	145
	number of layer per farm (thousands)	0.07	0.65	-	21	24

Table 2 Trends in the Supply of and Demand for Animal Products in Japan

		1980	1985	1990	1994 (approximate figures)
Milk and Dairy Products	Demand(thousand tons)①	7,943	8,785	10,582	11,481
	Production(thousand tons)②	6,498	7,436	8,203	8,387
	Imports(thousand tons)	1,411	1,579	2,237	2,732
	Selfsufficiency rate(%)②/①	82	85	78	73
	Per capita annual consumption(kg)	65.3	70.6	83.2	89.2
Beef	Demand(thousand tons)①	597	774	1,095	1,454
	Production(thousand tons)②	431	556	555	581
	Imports(thousand tons)	172	225	549	834
	Selfsufficiency rate(%)②/①	72	72	51	42
	Per capita annual consumption(kg)	3.5	4.4	6.1	8.0
Pork	Demand(thousand tons)①	1,646	1,813	2,066	2,084
	Production(thousand tons)②	1,430	1,559	1,536	1,377
	Imports(thousand tons)	207	272	488	719
	Selfsufficiency rate(%)②/①	94	92	82	73
	Per capita annual consumption(kg)	7.7	9.1	10.2	10.5
Poultry	Demand(thousand tons)①	1,194	1,466	1,678	1,743
	Production(thousand tons)②	1,120	1,354	1,380	1,267
	Imports(thousand tons)	80	115	297	489
	Selfsufficiency rate(%)②/①	94	92	82	73
	Per capita annual consumption(kg)	7.7	9.1	10.2	10.5

Table 3 Performance of Livestock in Japan

1、Dairy Cattle

Year (unit)	Milk Yield (kg)	Fat contents (%)	Solid-non-Fat (%)
1975	4,464	3.44	8.18
1980	5,006	3.55	8.40
1985	5,640	3.64	8.52
1990	6,383	3.75	8.58
1995	6,986	3.83	8.66

2、Beef Cattle

Yaer	Daily gain		TDN per 1kg weight gain	
(unit)	Wagyu steers (kg/day)	Dairy breed (kg/day)	Wagyu steers (kg/day)	Dairy breed (kg/day)
1975	0.57	0.97	9.33	-
1980	0.59	1.01	9.61	7.18
1985	0.61	1.05	9.14	6.72
1990	0.64	1.07	8.84	6.64
1995	0.64	1.07	8.56	6.33

3、Pigs

Year (unit)	Number of piglets (heads)	Delivery interval (day)	Daily gain (g)
1985	10.6	155	555
1990	11.0	151	547
1995	10.7	151	564

Table 4

Composition of livestock breeds in Commercial farms
(February, 1996)

1、Dairy Cattle

Holstein	99.5%
Jersey	0.5%

2、Beef Cattle

Japanese black(Wagyu)	91.7%
Japanese brown	5.3%
Japanese short-horn	1.5
Angus	0.7
Hereford	0.2
Others	0.6

3、Pigs

Landrece	1.4%
Large White	0.7%
Duroc	1.1%
Berkshire	1.8%
Hampshire	0.1%
Other pure Breeds	12.9%
Crossbreeds	82.0%

4、Chicken

Broilers and Layers are almost crossbreeds in commercial farms

Table 5

Status of Artificial Insemination (AI) and Frozen Semen in Japan (1995)

	(Unit)	Dairy Cattle	Beef Cattle
Number of mating cows	heads	1,542,045	689,765
Number of AI cows	heads	1,534,990	664,110
Share of AI	%	99.5	96.3
Number of AI cows by Frozen Semen	heads	1,533,777	664,050
Share of Frozen Semen	%	99.9	100.0

Table 6 Change of Bovine Embryo Transfer (ET) and In Viotro Fertilized (IVF) Service Offices

	1970	1975	1980	1985	1990	1995
ET						
Goverment and Local Goverment	2	6	12	65	71	75
University, Companies and Others	0	0	7	41	170	367
Total	2	6	19	106	241	442
IVF						
Goverment and Local Goverment					48	42
University, Companies and Others					28	60
Total					76	102

Table 7 Change of Number of Recipient Cow and Calves by ET, IVF

	1975	1980	1985	1990	1995
ET					
Number of Recipient Cow (heads)	10	498	5,034	19,865	40,742
Number of Calves (heas)	1	73	887	5,912	11,322
IVF					
Number of Recipient Cow (heads)				3,916	4,642
Number of Calves (heads)				621	1,216

QUESTIONNAIRE

To the Ex-participants
of
Breeding and Artificial Insemination in Cattle

We will greatly appreciate your cooperation in answering the following questions for making this survey an effective one. Please kindly write in block letters or typewritten.

Ⅰ.General questions

1 .Full name：____
(Dr.Mr.Mrs.Ms.)

2 .Year of your participation and name of the course：____________________

3 .Name of the organization you are working at the moment

Name of the organization________________________________

Department ______________________________________

Division ______________________________________

Section ______________________________________

4 .Present post：______________________________________

5 . Office address：______________________________________

Tel：________________

6 .Home address：______________________________________

Tel：________________

7 . Employment record (after the participation to the course)

Organization　　　　Position　　　　Duration of Service

8 . If you have participated another training course, please mention it.

Duration of training	Name of Institute (Country)	Objective of training

Ⅱ . Questions on your present job

1 . Please describe the major activites of your organization.

2 . Please give a brief description of your duties in the present job.

3. What do you consider the greatest obstacles in accomplishing your present job.

i . Technical Problems

ii . Socioeconomical and Others

4 .What is the most serious issues in the Livestock Industry of your country?

a. National Level

b. Your office Level

c. Personal Level

5 .How do you improve your technology and how do you get the new information and ideas on AI for Cattle.

6 .Please describe the present situation of AI technology in your country and your laboratory (if you are researching or applying them).

III. Questions on the course you attend

1 .To what extend had the training fulfilled to your expectations?

☐ Completely ☐ Highly ☐Somewhat

☐Hardly ☐ Nor at all

Comments :

2 .To what extent can you apply the knowledge／skills acquired during the training in your present job.

☐ All ☐ Most ☐Some ☐None

Comments :

3 .To what extent did the training you attended contribute to the personal improvements?

☐ A lot ☐ Somewhat ☐Not at all

If there are, how are they helpful?

☐ Work conditions ☐Obtaining better job

☐ Responsibility ☐Professional recognition

☐ Salary-wise ☐International contacts

☐Prospects for the future ☐Others

Comments :

4 .What are the two most useful and applicable subjects which you learned in the course?

(a) ______________________________

(b) ______________________________

Comments :

5 . If you want to add two subjects to the course, what would they be?

(a) ______________________________

(b) ______________________________

Comments :

6 .Do you have any proposals or suggestions for the improvement of the future course?
(e.g.duration , season , number of participants , curriculum , textbooks , facilities , time allocation , topics, practice , study tours etc.)

Ⅳ. Questions on the follow-up activities

1 .What kind of follow-up activities from JICA or NLBC have you gotten so far?

(1) Receiving literature, journals or technical information

☐Kenshu-in ☐Farming Japan

☐Technical reference book ( )

(2) Others

2 .What kind of follow-up activities of the course do you request?
Please tick off the appreciate item and describe the concrete idea of the request.

☐Sending literature and technical information

____

☐Technical consultation ______________________________

☐Re-training or re-fresher training course

____

☐Others, if any (donation of equipment or facilities , dispatching Japanese experts and youth volunteers so on)

____

3 . Do you have any sort of contact with other ex-participants of the same course in and out of your country?

4 . Do you have any relationships with Japan in the course of your job or any social activities in your country?

5 .Any other comments

QUESTIONNAIRE

To
the Relevant Authorities
of

Breeding and Artificial Insemination in Cattle

We will greatly appreciate your cooperation in answering the following questions for making this survey an effective one.

please kindly write in block letter or typewritten.

Ⅰ.General Questions

1 .Name of your organization

Address :
Tel :
Fax :

2 .Your name & position

3 .Please give a brief explanation on the duties／services of your organization.

4 .Organization chart (attached paper)

II . Nominating Process

1 .From where and when do you get the GI (General Information) for the course?

2 .Please describe the nominating process and approximate time required at each process.

Process	Time
·	
·	
·	
·	
·	

3 .What kind of orientation do you give to confirmed participant before his ／her leave for Japan?

4 .How & by what standard do you finalize nominated candidates?

III . Evaluation of the Results of Training

1 . What kind of report do you get from participants after they return?

2 . Do you evaluate the output of the training after participants return from Japan?

Yes → ① How?

No → ② Is the evaluation reflected to the next dispatch?
Yes
No → reason

3 . How do you utilize the knowlege & information that participants brought?
(What kind of assistance do you give to the ex-participants?)

4 .Dose the evaluation reflect on the ex-participants' . promotion?

Yes → give some example
No →

5 .What do you think is the hindrance. for ex-participants to utilize what gain in Japan?

Ⅳ. Future task and prospect

1 .What are the major technical difficulties in Livestock Industry in your country?

2 .What type of assistance do you think Japan can give to overcome those difficulties?

- Training in Japan
- Dispatch of expart
- Supply of equipment
- Others→Like what?

} → Why?

3 . What kind of subjects should be added to the course?

4 .Has your organization assigned your Staff member or relevant personal in this field to participate in a similar training course／seminar held by foreign countries (organization) other than Japan?

No

Yes→CountryOrganization	Duration	Objective