

THE GOVERNMENT OF THE REPUBLIC OF INDONESIA
ON
THE PROPOSAL FOR ESTABLISHMENT
OF
THE FOREST AREA MANAGEMENT DEVELOPMENT CENTER
IN
THE REPUBLIC OF INDONESIA

NO. 1890

MINISTER OF FORESTRY AND WILDLIFE



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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a Basic Design Study on the Project for Establishment of the Forest Tree Improvement Development Center and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a survey team headed by Mr. Shigeru Eiga, chief of Breeding Div., Kanto Forest Tree Breeding Institute, Forestry Agency, Ministry of Agriculture, Forest and Fisheries, from November 27 to December 26, 1989.

The team exchanged views with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft report, and the present report was prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between the two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the teams.

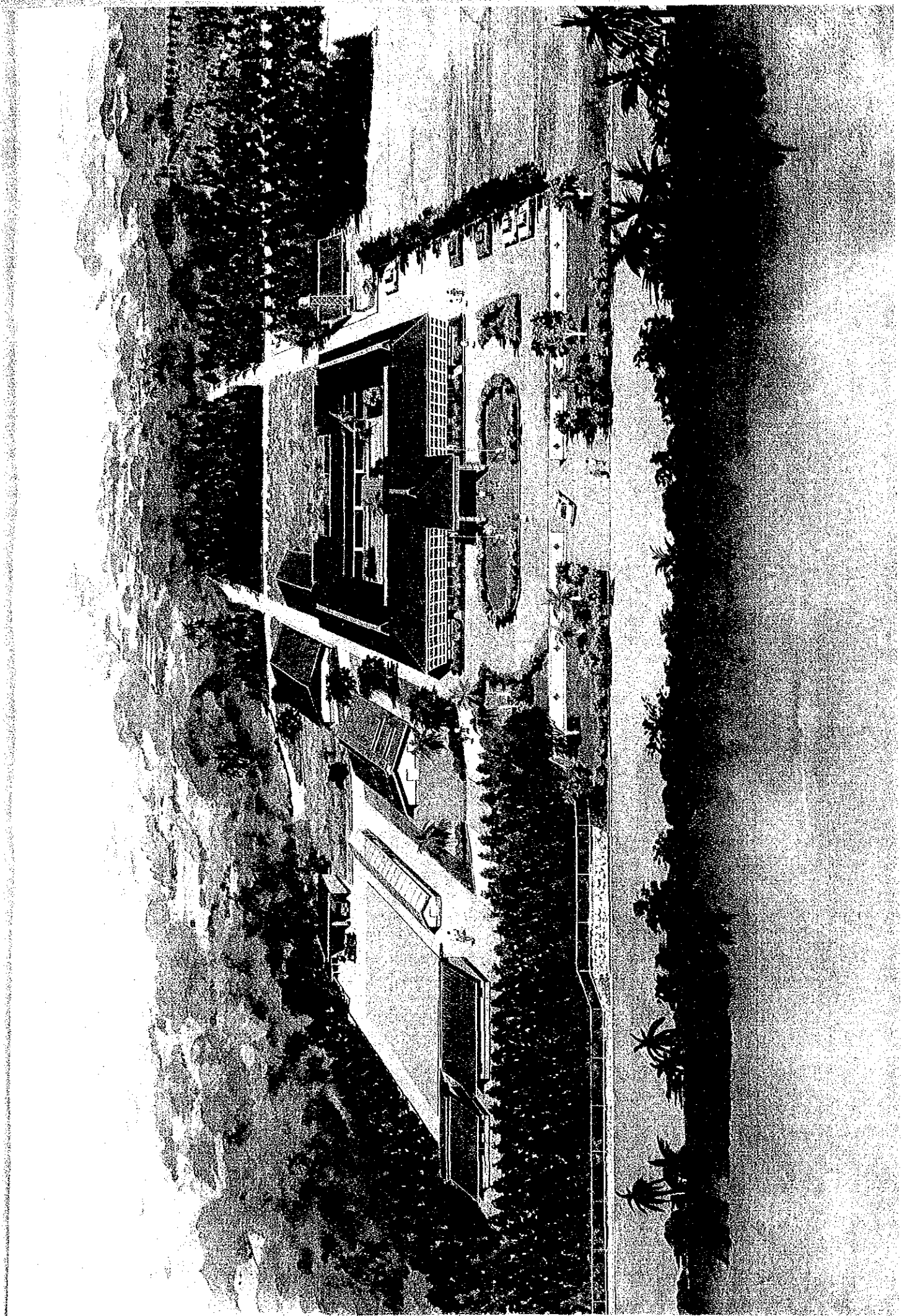
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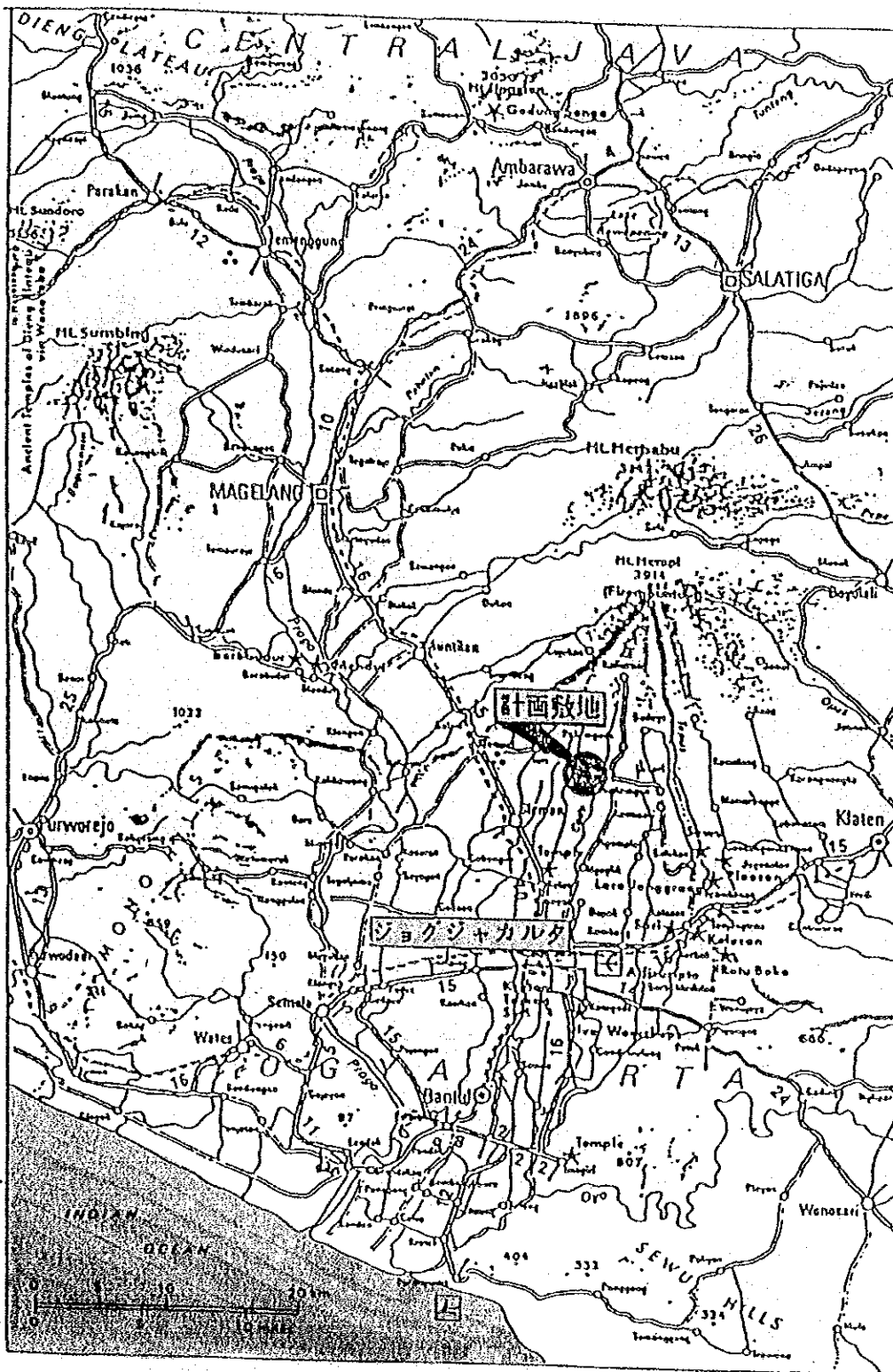
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President

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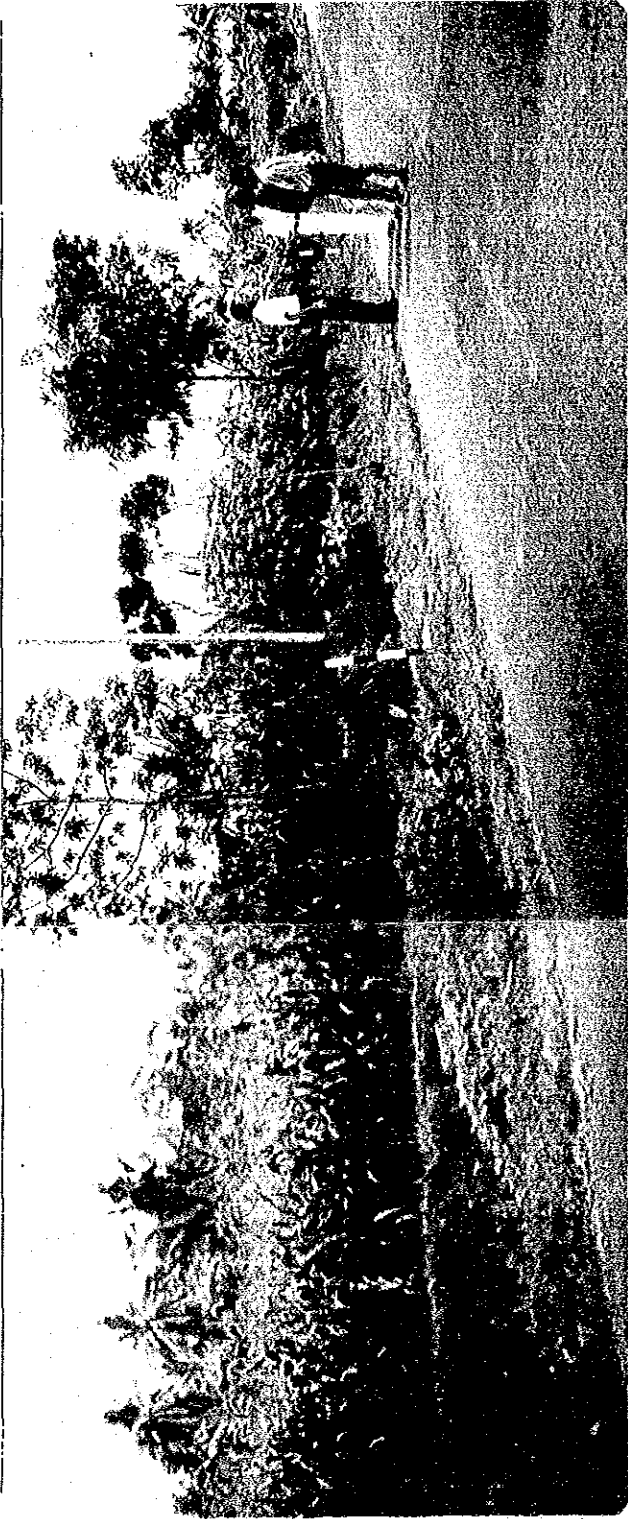
YOGYAKARTA



Project site

Jogyakarta

建設予定地
PROJECT SITE



SUMMARY

SUMMARY

The Republic of Indonesia is the nation with the largest number of islands in the world, located over a total distance of approximately 5,100 kilometers, from Saban on Sumatra Island in the west to Merauke on Irian Jaya Island in the east. Geographically, it is situated between 6° N.L. and 11° S.L. and between 14° and 95° E.L. The nation's land area totals approximately 193,072,000 ha, nearly 5.5 times that of Japan, and is composed of 13,667 large and small islands, some 3,500 of which are inhabited. Its total population is approximately 165,000,000, ranking 5th in the world.

The Indonesian economy is lagging behind those of the neighboring ASEAN countries, but has recently been improving at a steady pace. In 1984 the country established a self-sufficient rice supply system. Recently, exports of industrial products have increased, accounting for 13.4% of total exports in 1986. This has resulted in a change in the country's economy which had previously depended solely on the export of petroleum and gas. Growth in industrial exports largely depends on forest products, therefore the country's forests are a resource of tremendous importance.

Also, the preservation of the Southeast Asian tropical rain forests centering on Indonesia has recently attracted worldwide attention, together with that of the Amazonian rain forest. However, an area of 500,000 ha is reportedly devastated every year due to the practice of shifting cultivation necessitated by population growth, as well as deforestation for development projects. Consequently reforestation and the preservation of existing forests have become the most urgent tasks in the government's forestry policy from the viewpoints of lumber production, land preservation, and the conservation of hereditary resources.

For these reasons, the Indonesian Government is contemplating an industrial reforestation of 4,200,000 ha as part of its 4th ~ 6th 5-year National Development Plans. The uninterrupted implementation of this reforestation plan will require a stable supply of seeds and the improvement of seed quality, which can be achieved by tree breeding. Therefore, providing a central facility for tree breeding will fulfil an important role in the implementation of the national reforestation plan.

However, as the Government of Indonesia is in a distressed financial state, there has been little progress in both the construction of facilities and the purchase of equipment and materials. Consequently, in March 1989, the government formally requested assistance from Japan for the establishment of the Forest Tree Improvement Development Center, along with the training of personnel for technological improvement in the tree breeding field, as Japan has a high-level of tree breeding technology and also has experience in cooperation with Indonesia in industrial reforestation.

In response to this request, the Government of Japan decided to conduct a preliminary study of a plan for the establishment of the Forest Tree Improvement Development Center. So JICA, on behalf of the Government of Japan, sent to Indonesia a study team to confirm the objectives and details of the Project, as well as to examine the feasibility of extending cooperation, in August 1989.

As a result, the proposed plan was deemed adequate as a Grant Aid project. JICA sent a basic design study team to Indonesia for the period between November 27 and December 26, 1989 to hold discussions on and make investigations into what facilities and equipment would be optimum. After returning to Japan, the team analyzed the results of local investigations. This was followed by establishment of plans for the basic design and maintenance/control of the proposed facilities and equipment, and has led to the preparation of a draft basic design study final report.

For the purpose of explaining the contents of the draft final report, JICA sent another mission to Indonesia to determine the details of the Project (as mentioned below) from April 2 to 7, 1990.

The objective of the proposed project, which includes a possible offer of equipment, is to build a Forest Tree Improvement Development Center having activities focussing on the development of tree-breeding technology, the collection of seeds from existing species, the production of superior seeds from genetically improved, fast-growing trees, and the processing of tree-breeding related data, for the smooth implementation of Indonesia's industrial reforestation activities.

The project implementation organization is the Directorate of Reforestation and Regreening, Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry.

The site scheduled for the construction of the Project's facilities, a 5.5 ha sugar cane field already purchased by the Ministry of Forestry, is located about 12 kilometers north of Yogyakarta Propins.

Through the above-mentioned confirmation, the mission came to the conclusion that the proposed center could improve the technologies of Indonesia's forestry industry and other related industries, and this could lead to further development of the national economy.

Optimum facilities and the equipment required for the Project are as follows:

- Location of construction site
Pelem Dusun, Purwobinangan Desa, Pakem Kacamatan, Sleman Kabupaten, Yogyakarta Propins.
- Planned facilities and their sizes

1. Facilities

1.1 Main Building (2,585.66m²)

1F : Head's Room, Specialists' Room, Office Room, Laboratory, etc.
--

2F : Seminar Room, Conference Room, Research Room, Laboratory, Library, etc.
--

1.2 Related Facility Buildings (1,423.3m²)

Workshop for Wood, Cross Breeding Building, Cone Drying Room, Workers' Room, Equipment Storage, Oil Storage, Pump House, Garage, Soil Burning Place, Hothouse with Mist, Electric Generator, Power Distribution Room, etc.
--

2. Equipment

Laboratory equipment	Stereomicroscope with photographing device, clean bench, micro-densitometer, etc.
Equipment for field work	Data collector, transit, level, etc.
Equipment for working	Tractor, dump trailer, plow, etc.
Data processing equipment	Personal computer, lap-top personal computer, etc.
Vehicles	Standard wagon, pick-up, 4WD truck, mini-bus, etc.
Weather observation equipment	All-weather type data measuring recorder.
Office and audiovisual equipment	Copier, facsimile machine, slide making machine, etc.

- Approximate estimate of the project costs borne by Indonesia

Indonesian portion of infrastructure, etc. .. ¥ 34,900,000 (approx.)
Rp 436,945,000 (approx.)

- The estimated cost required for the annual maintenance and control of the proposed facilities and equipment is ¥4,980,000, excepting personnel expenses. If the Project is to be executed with grant aid from Japan, it is desirable to do so in two phases in view of the required construction costs, etc.; twelve (12) months for Phase I and seven (7) months for Phase II.
- The execution of detailed design and bid preparation requires 5.5 months for Phase I, and 3 months for Phase II.
- The breakdown of each phase is as follows:

Phase I : Main Building.

Phase II : Related facility buildings and equipment.

The team feels that implementing the proposed project will enable the scheduled production and stable supply of seeds and scions for the country's industrial reforestation; breeding genetically-improved, faster-growing species will improve forest productivity; and through the proposed project, an extensive range of information on manpower training, seeds, scions, tree improvement, and reforestation can be collected and utilized. These results will make a significant contribution towards an improvement of reforestation technologies involved in the protection and revitalization of the country's tropical forests.

Furthermore, the project implementing agency of the Indonesian Government, as well as the budgetary measures required, are not expected to give rise to any problems, and hence the extension of Japanese grant aid to the proposed project is recommended.

However, in order to further enhance the actual benefits of the proposed project, it is recommended that the Indonesian Government ensure the training of a sufficient number of staff at the earliest possible time with the close involvement of the Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry, secure budgets for the forestry center's activities, establish subcenters at an early date, as well as implement project-type technical cooperation with Japan.

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SECTION 1 INTRODUCTION

SECTION 1 INTRODUCTION

With the steadily improving economy of recent years, the Republic of Indonesia established a self-sufficient rice supply in 1984. Recently, the country has been rapidly increasing production of textiles, cement, fertilizer, paper, iron and steel, aluminum base metal, and plywood, which suggests that the export industries of the country are growing. The country's infrastructure is being upgraded, with the pavement of roads, the renovation of bridges, the construction of grade separation roads and footbridges, along with the growing distribution and improving quality of electric power which has considerably reduced the frequency of power shortages. Telephone communications have been also improved to a certain extent. Consumer goods such as radios, cassette recorders, televisions, clocks, wristwatches, calculators, and video players have been extensively disseminated among the public. On the assumption that the intake of 2,100 calories per diem per capita is the poverty line, the population living below this line was 54,200,000 in 1976, or approximately 40% of the total population, but has since decreased to 34,900,000 in 1984 or approximately 20% of the total population.

However, in spite of its current steady economic growth the country still has a number of problems such as earning differentials, increasing foreign debt, the growing labor force, and high reliance on petroleum and gas, and finding solutions to these problems is the key to the country's economic development.

In order to ease the high dependence on petroleum and gas, the country is expecting a further expansion of exports, particularly textiles, cement, fertilizers, and forestry products, particularly lumber and plywood. The nation is very dependent on forestry products as forests account for approximately 75% of the country. The country has implemented four 5-year plans in the past to ensure effective use of forest resources as well as encourage the forestry industry.

The 5th 5-year Forestry Plan (1989/90 ~ 1993/94) is intended to promote forest preservation and development by reforestation based on the National Development Plan. Furthermore, for 15 years from the 4th plan until the 6th plan, an industrial reforestation of 4,200,000 ha is projected, and,

to this end, environmental improvement is under way. However, the forestry industry of the country has the problems of

- 1) a progressive reduction in superior trees due to shifting cultivation and deforestation, and
- 2) a shortage of tree-breeding technologies suited to the regions.

In addition, although the Seed Source Development Center in Kaliurang is the only facility to conduct tree breeding in the country, it is incapable of carrying out either seed production or the development of breeding technology because of its deteriorating facilities and a shortage of essential equipment and apparatus.

Consequently, the Indonesian Government has made a request to the Government of Japan for grant aid and technical cooperation for establishment of the Forest Tree Improvement Development Center, because the country lacks sufficient funds to carry out the Project and needs to educate personnel for tree breeding.

The Government of Japan decided to conduct a preliminary survey on the Project. JICA, on behalf of the Government of Japan, sent a preliminary survey team to Indonesia in August 1989 to discuss the objectives and details of cooperation as well as consider the feasibility of providing Grant Aid for establishment of the Forest Tree Improvement Development Center.

As a result of its surveys, the team concluded that the Project can greatly contribute to the preservation of the country's forest resources and the furtherance of its industrial reforestation plan, and therefore the JICA sent a basic design study team headed by Mr. Shigeru Eiga, chief of Breeding Div., Kanto Forest Tree Breeding Institute, Forest Agency, Ministry of Agriculture, Forestry and Fisheries, to Indonesia from November 27 to December 26, 1989.

The team confirmed and discussed the details of the Request, conducted surveys on the background of the Project and on the local conditions, confirmed the Project procedures, explained to Indonesian Government officials the formalities of the Grant Aid System of Japan, and further

confirmed the undertakings of the two governments in preparation for the execution of the Project.

Based on these local survey results, JICA examined the adequacy, details, scale, execution schedule and cost of the Project, and, after giving an explanation of the draft final report, compiled the results into this report.

The team members, survey itinerary, list of key interviewees, and copies of the minutes of meetings are attached as Annexes 1 ~ 4 at the end of this report.

SECTION 2 BACKGROUND TO THE PROJECT

- 2-1 General Conditions in Indonesia**
- 2-2 Outline of Forestry Industry**
- 2-3 Outline of Supporting Organizations**
- 2-4 Evolution and Detail of the Request**

SECTION 2 BACKGROUND TO THE PROJECT

2-1 General Conditions in Indonesia

2-1-1 Natural Environment

The Republic of Indonesia is situated between the two continents of Asia and Australia and between the Indian Ocean and the Pacific Ocean, and has a wealth of natural resources. It is the nation with the world's greatest number of islands extending over approximately 5,100 km from Saban in Sumatra in the west to Meranke in Irian Jaya Island in the east. Geographically, the country is located between 6° N.L. and 11° S.L. and between 95° E.L. and 14° E.L. The total area of the country is approximately 1,920,000 square kilometers or some 5.5 times the size of Japan. It is composed of 13,667 large and small islands; and some 3,500 of these islands are inhabited. The country has a total population of an estimated 165,000,000 in 1985 (based on the 1980 census), the 5th largest in the world.

The climate is tropical, and because of Indonesia's location near the equator, there is little seasonal change, but there are two seasons; the rainy season and the dry season. The annual mean temperature is around 27°C, with minimal temperature change throughout the year. The average rainfall is approximately 700mm, as it is in the equatorial rain zone. The rainy season in Java generally occurs from October to March, and the dry season from April to September. Approximately 75% of the country is covered with forests, making Indonesia the world's largest tropical forest nation. These forest zones play an important role in the promotion of the country's forestry industry as source of wood resources such as lumber, plywood, and other wood resources.

2-1-2 Social Environment

The farming region of Java is inhabited by about half its total population, and does not allow for any population increase. In addition, both modernization and labor-saving innovations in agricultural production have led to the reduction of employment opportunities. Hence, the

overpopulation of farming villages has caused migration into the cities, resulting in the swelling of the urban population.

The concentration of overpopulation in the cities has raised the most serious problems in the cities in Java. Similar phenomena are seen in Medan, Padang (both on Sumatera), and Ujun Pandang (Sulawesi). To prevent the overpopulation of the cities in Java, the government is proceeding with the transmigration plan of relocating the excess population to the farming regions on the island of Sumatra, but with little success so far due to the undeveloped infrastructure in the receiving region, the strong bonds of Javanese with their homeland, and the social customs based on mutual assistance between people from the same village and relatives.

Also, the great difference between the traditional culture of an agricultural village and the culture of a modern city has been a major problem in the country. Various political measures have been executed to correct the above mentioned imbalances to ensure impartial development and distribution of income throughout the country.

2-1-3 Outline of the Economy

(1) The 5-year Development Plan and its achievements

The Suharto administration which was inaugurated in 1965 has ensured political stability by focusing on the development of the economy. Firstly, an economic rehabilitation plan including the introduction of foreign aid and investment was drafted, followed by the First 5-year Plan centering on the establishment of self-sufficiency in food supply in 1969 and the improvement of infrastructure. Because of the relatively stable transition of the political and economic situations both at home and abroad, the First 5-year Plan enabled the real GDP growth to reach an average of 7.7% and achieved some success in increasing rice production, and stopping inflation.

In 1974, the Second 5-year Plan was enforced and the country tentatively enjoyed great benefits due to the rise in the crude oil

export price created by the first oil crisis. However, because of the subsequent worldwide recession and the financial bankruptcy of PERTAMINA PETROLEUM CORPORATION in 1975, the GDP growth stalled at 6.9% against the target of 7.5%, and in November 1978 the government was compelled to greatly devalue the rupiah by 50%.

In 1979 the Third 5-year Plan was implemented. The country again benefitted from the hike in the crude oil export price. In addition, a variety of institutional revisions in economic policy covering taxation, customs duties, the encouragement of exports and the encouragement of medium and small enterprises, were implemented. This resulted in remarkable development of the economy. However, along with the aggravated worldwide recession since 1981, the petroleum business has continued to be sluggish, and as the country's economy, which largely relies on oil exports, was hit by the so-called counter oil crisis, causing 1982 growth to sharply drop to 2.2%.

In order to supplement the shortage of state revenue caused by the drop in the crude oil export price, the rupiah was devalued by 38% from US\$1/Rp703 to US\$1/Rp970 in March 1983, and measures such as review of major projects were undertaken in May 1983, thereby improving the growth rate slightly in 1983 to 4.2%. On the whole, however, the Third 5-year Plan ended in recession. The average growth rate during the period of the Plan stood at 6%, less than the target of 6.5%.

The Fourth 5-year Plan was commenced in 1984. Because of the unclear outlook for international demand for oil, the target growth rate was set at an annual average of 5%, lower than that of the previous plans. This plan aimed at doubling the exports of non-petroleum products and gas products. Also, in order to realize a well balanced industrial structure, the plan placed emphasis on the development of industries, with the annual average growth rate targeted at 9.5%.

In 1984, which was the first year of the plan, the manufacturing industry marked considerable growth and the agricultural industry

progressed at a steady pace, thereby achieving a growth rate of 6.0%, in excess of the target. However, the annual growth rate of 2.3% ground to a halt in 1985 due to a decline in the mining industry, particularly petroleum. The international petroleum price again marked a sharp fall in 1986, dealing a severe blow to the country's economy and compelled the government to devalue the rupiah by 45%. Despite all these factors, petroleum production increased, and transportation, telecommunications, commerce and finance slightly recovered to a growth rate of 3.2%.

In the national guidelines decided at the National Conference held in March 1983, the government aimed at "Taking off Towards the Development of an Impartial, Thriving Society" during the period (1994 ~ 1999) of the Sixth 5-year Plan, based on the Pancasila, but this goal was accompanied by a great many challenges such as the rapidly increasing population and latent unemployment; earnings and economic differentials between classes, between urban regions and farming regions, and between races; the excessive dependence of the economy on petroleum, and the imbalance between the consumer goods sector and capital sector, and between private assets and public assets. (Refer to Annex 5 for the transition of major economic indexes.)

(2) Industrial structure and employment structure

(a) Industrial structure

Indonesia is an agricultural country with a wealth of resources represented by petroleum and gas.

Of the 1986 industry, agriculture and fisheries industries account for 25.8%, mining industry, 11.1%, manufacturing industry, 14.4% and commerce, 16.7%. Compared with 1970, the ratio of the agriculture and fisheries industries declined to almost half, while that of the mining industry doubled. (For changes in the labor and employment structure, refer to Annex 6). This resulted from the petroleum price which rose markedly on two occasions in 1973 and 1979 due to the oil crisis. Although the manufacturing

industry has marked a steadily increasing rate, it still falls at a level lower than that of other ASEAN countries.

Looking at real annual average growth of production rates by industry in 1970 to 1983, the construction industry marked the highest at 14.9%, followed by 13.3% for electric power, gas and water, 11.9% for manufacturing industry, and 11.7% for transportation and telecommunications. This suggests that emphasis was maintained on national development projects during the 1970 ~ 1983 period. Conversely, agriculture and fisheries stayed at the lowest position with 3.8%, followed by 5.5% for mining industry and 8.4% for commerce, finance and services. From 1983 onwards, high growth rates have been achieved by the manufacturing industry, the financial industry, the transportation industry and the telecommunications industry.

(b) Employment structure

Based on the 1985 census, agriculture and fisheries accounted for 54.7% of the total number employed, indicating that dependence on the agriculture and fisheries is still high. This is followed by 15% (commerce and food and drink), and 13.3% (public services). The ratio of the gainfully occupied in the manufacturing industry increased from 6.6% in 1971 to 9.3% in 1985, but is still at a low rate. The government still has a huge task in planning for the employment of the labor force which is predicted to greatly increase in the future, in the manufacturing industries.

2-1-4 Outline of the 5-year Development Plan

Since 1969 when the development of an economy based on the 5-year Plan was commenced, the country had recorded a high growth rate of 7.9% by 1981 thanks to the oil booms on two occasions. Simultaneously, as a result of the positive promotion of development projects by making use of increasing petroleum revenues, dependence of the economy and national finance on petroleum grew further, resulting in increasingly aggravated current transactions due to lack of sufficient demand for petroleum exports from

1981. Finally, in 1982, the government was confronted with a crisis in the balance of international payments and national finance.

For this reason, the government introduced a counter purchase system in 1983, and carried out a series of economic reconstruction policies such as the encouragement of the export of non-petroleum products, restraint on imports, devaluation of the rupiah, and re-evaluation of development projects (Annex 7). These economic reconstruction policies aimed, on a short-term basis, at avoiding crises in the balance of international payments and national finance, and alleviating the country's excessive dependence on petroleum, on a long and medium-term basis. In the Fourth 5-year Plan, the policies were basically oriented towards the above mentioned aims, and conservative targets were set.

The Fourth 5-year Plan, commenced in April 1984, was to be the period for creating a fundamental framework on which the country could grow independently (see Annex 8 for the planned values).

The objectives of the Plan include improvement of living standards, educational facilities and welfare, and the establishment of a steady foundation for subsequent development projects. Economic development is regarded as the first priority. As a comprehensive target the agricultural policy focuses on self-sufficiency in food supply while the industrial policy centers on the manufacture of industrial equipment.

In the financial policy, emphasis is placed on the augmentation of income from non-petroleum products and the increase of government savings by the efficient payment of ordinary expenses, along with a continuation of a balanced budget. The policy for the balance of international payments and international trading specifically emphasizes the expansion of industrial product exports as well as a deliberate policy for foreign debts. However, it is obvious that execution of these policies has been considerably behind schedule as the Annual Budget Announcement stated, though no detailed statistics have yet been made public about the progress of the Fourth 5-year Plan.

The Fourth 5-year Plan appears to have been completely derailed from the government's expectations due to the unexpected decline of petroleum

prices following the outset of the Plan, the resulting large reduction in tax revenue from petroleum, and sluggish domestic demand resulting from stagnant public investment.

2-2 Outline of Forestry Industry

2-2-1 Outline of Forest Resources

Approximately 75% or 144,970,000 ha (including converted and coastal forests) of Indonesian is covered by forests, with approximately 5,500,000,000m³ of resources; thus Indonesia is one of the largest forest countries. The ratios of forest resources by island are as follows (Annex 9): Sumatra 18.9%, Java 2%, Kalimantan 56.5%, Sulawesi 6.5%, Nusa Tenggara 0.1%, Maluku 6.1%, and Irian Java 11.9%. The three islands of Sumatra, Kalimantan and Irian Java account for approximately 90% of the total forest resources.

However, despite the country having the rich forest resources as mentioned above, data from the Ministry of Forestry indicates that a total of undeveloped areas is 18.4 million ha, and no measure has so far been taken for the revitalization of these devastating weir areas (Annex 10). For this reason, the revitalizable areas of these weirs are decreasing year after year; a reduction of 1.5% to 4.7% on Java and an estimated 15 ha becoming un-revitalized every year on other islands. This situation has resulted chiefly from shifting cultivation, illegal tree cutting and wood fires.

In Indonesia, forests are classified into five categories (Annex 11). They are 21% protected forest, 13% parks and preserved forest, 21% restricted production forest, 24% unconvertible production forest and 21% convertible production forest. The country has a long history of reforestation, dating back to the 1880s when the reforestation of teak was carried out for the first time on Java. Since then, reforestation has been continued, and in 1985 the total afforested area reached 258,000 ha.

2-2-2 Position of Forest Development in National Development Plan

- (1) The target of the country's Fourth 5-year Plan (1984/85 ~ 1988/89) is to ① raise the people's standard of living and welfare in a more impartially and equal way and ② create a firm foundation for future development stages. In the National Development Plan, forestry is placed within the agricultural division. The National Development

Plan states that the reforestation policy should be conducive to the protection of forests, soils and sources of streams as well as the prevention of flood damage etc."

The majority of forest production is carried out by government enterprises and INHUTANI to which the right of development is granted. In the National Development Plan, the right of forest development will be expanded so that an enterprise which intends to undertake forest development shall be obligated to provide a center to carry out reforestation, tree breeding and harvesting. A method for further sophisticated forest administration suggesting that the country's forestry industry includes the whole process from cutting timber to growing forest, is to be adopted.

The National Development Plan has set directives for the period of the Fourth 5-year Plan, during which production of logs should be increased by 8.4% per annum, that of lumber by 8.0% and that of plywood by 11.6%. Also according to the Plan, the export of logs was to be suspended while a plan for the increase of annual exports was established; 10.3% for lumber and 10.6% for plywood. Although the Plan itself includes no details to support these percentages, its forestry plan includes some ambitious figures; in which the real economic growth rate is set at 5.0%.

(2) **Position of Reforestation, Regreening and Industrial Plantation Plan in the Fourth Forestry Development Plan**

A plan specifying that the Fourth 5-year Development Plan was in the forestry industry and the outlook for the period (until 1999) of the Sixth 5-year Plan, was made public as the "General Plan for Forestry (RENCANA UMUM KEHUTANAN)" in July 1986, along with various supporting materials (see Annex 12-1 for key indexes).

The said plan places emphasis on the following:

- ① Definite location of forest areas according to accurate information on forest resources,

- ② Protection of ecosystems which is vital to the maintenance of life on Earth,
- ③ Development of protection for sources of streams, soils and environment,
- ④ Maximum realization of the ecological function of forests for the population,
- ⑤ Improvement of research and development in the forestry industry, and application of the results, and
- ⑥ Development of manpower through professional and administrative training.

Although Indonesia has some of the largest forest resources, the country is predicted to suffer from a shortage of lumber by the year 2000 except in three regions; the State of East Kalimantan, the State of West Kalimantan and the State of West Irian, if its forestry industry continues to develop at its present rate. To prevent such an outcome, the government plans to conduct reforestation of 4.2 million ha and greening of 8.5 million ha for a period of 15 years beginning in 1985, along with proper administration of natural forests. However, achievements by 1987 indicate reforestation of 1.8 million ha, greening of 3.6 million ha, and an industrial reforestation of only 32,000 ha (accounting for the completion of 32% of the target), suggesting a difficulty to obtain adequate results.

2-2-3 Development of Reforestation and Regreening under the Fifth Development 5-year Plan

- (1) Basic policies for development of the forestry industry and protection of forests

The country's basic policies for development of its forestry industry and protection of forests are as defined in the National 5-

year Development Plan and a speech by the president delivered at an official event.

In the Guidelines of State Policy (GBHN) announced in 1988, development of the forestry industry is

① Placed in the agricultural industry (Item I.A: General Agriculture), and should be as follows:

- a. Development of the forestry industry should be carried out in a modern, effective and steady way, and
- b. Development of the forestry industry should entail the improvement of productivity and quality, an increase in earnings and income, the augmentation of employment opportunities, the encouragement of enterprises, the fostering of industries, and exports.

② Also, the following matters are defined in Item I.F: Forestry:

- a. Management of forests, which are important natural resources, should be carried out in such a way as to best benefit the people,
- b. Forests should be permitted to play an important role as a source of income as well as employment,
- c. An effort should be made for the expansion of usage of forests, improvement of forest locations and expansion of usage of forest products, in order to develop the industry and maintain the supply, and
- d. Continuous efforts should be made for the protection and preservation of forests, reforestation, natural forest management, and the development of lumber resources.

The plan further stresses that, in order to promote the foregoing basic policies, a concentrated effort should be made

for the restoration of forest areas and devastated lands, the management of river basins, the restriction of shifting cultivation, multi-use of forests, utilization of converted forests, preservation of the ecosystem, and improvement and dissemination of research, education and training on forests.

(2) Indexes of forest development

In the Fifth 5-year Plan, the indexes and target values with regard to forest development are defined as follows:

① Forest development program

Preservation of forests, land and water, reforestation, and restoration of damaged weirs, including investigation and assessment of resources and the environment (Annex 12-2).

② Forest investigation and measurement

Investigation of state forest resources, preparation of forest vegetation and ecology maps, and the making of boundaries of the forests scheduled for conversion, shall be carried out in order to increase the amount of information available, improve the quality of forest resources data, and provide optimum converted forests.

③ The augmentation of forest products

Production of 157,000,000 cubic meters of logs from production forests and converted forests, 1,120,000 tons of rattan, 511,000,000 cubic meters of firewood, 83,000,000 cubic meters of lumber and plywood, and 2,540,000 tons of pulp and paper. Domestic distribution of forest products, expansion of their sales, promotion of export of forest products, and promotion of forestry, investigation into re-resources in deforested land, supplementary planting, thinning and salvage cutting, reforestation, industrial reforestation, and development of reforestation techniques.

Of the foregoing items, a reforestation of 1,575,000 ha was completed as shown in Annex 12, but achievement of quantitatively sufficient reforestation would be very difficult with a view to the past results as described in 2-2-2 (2).

④ Preservation of forests and water resources

Natural forests of 75 ha, financial aid for the furnishing of nursery trees for model reforestation, antiflood facilities, recreational reforestation, and voluntary activities, management of farmland, and patrol of recreational forests.

2-2-4 Relationship between Problems of Industrial Reforestation and Tree Breeding Activities

Today's Indonesian forestry comes up against the global-scale problems that superior forests are on the decrease, and this has consequently created environmental damage in the form of increasing deterioration of weirs and progressing soil erosion.

Hence, the continued development of Indonesian forestry is recommended. To this end, sustained reforestation must follow its development.

In view of the above mentioned aspects, the industrial plantation and the regreening plantation underway in the country can be regarded as a timely policy for a sustainable reforestation plan accompanied by continued development.

To date, however, the country's annual reforestation plans have not been proceeding on schedule, chiefly due to the fact that the enormous amount of seeds, required for such reforestation, has not been ensured through systematic production.

This leads to the judgment that the production of superior seeds and seedlings is the most urgent task for continued reforestation.

The primary aim of the Indonesia's forestry policy for promotion of industrial reforestation, which is one of the mainstays of the country's economy, is to carry out reforestation at the deforested areas by planting the seedlings of fast growing species. The Center should fulfil its role of improving the quality of such seedlings in order to maintain forest water and soil resources as well and in the development of the lumber industry.

The activities for improvement of tree species for industrial reforestation use have been carried out mainly using *teak* and *pinus merkusii* but, in effect, the processes of selecting plus trees, carrying out progeny tests and introducing early fast growing species are still underway. Testing and research of species for forest trees have not been strongly promoted because of the shortages of necessary facilities and researchers.

Industrial reforestation has been carried out experimentally in certain regions. The techniques and organizations which support the reforestation activities are fully systematic, and therefore, a strategy for breeding techniques will have to be established.

The seeds and seedlings of species for industrial reforestation use have not yet been examined from the genetic point of view. As evident from variation in the extent of growth of seedling observed during tests, and from changes in their characteristics, these species are genetically diverse, so research should be conducted.

Based on the large variations among trees in growth and other characters within the existing industrial reforestation forests, the improvement of production output and tree characteristics by tree improvement can be theoretically possible. Because of short rotations, there is a great possibility that the effects of breeding can be realized in a short period.

(1) Tree breeding

The present status of breeding sources in the field of forest tree breeding is as described below.

① Seed Orchards

1,000 plus trees of *pinus merkusii* were selected and 100 families were selected based on the results of the progeny tests. A 30 ha of clonal seed orchards in North Sumatera, a 10 ha of those in Sulawesi. And a 96 ha of seedling seed were established, each in the west, central and east of the Java Island (Annex 13). *E. Europhyla* family uses the progeny test as seedling seed orchards, created by superior trees collectively selected from the natural forest in East Nusatenggara. The method to establish seed orchard for *kamerere* (*E. Deglupta*) is the same as the ones for *E. europhyla*, though the place from which it was selected is unidentified. The seed stands of the both species are located at ten places in Sumatera, Sulawesi, Nusatenggara, a total of 10 ha. Clonal seed orchards of *teak* were established, each 2.25 ha in West Java and Central Java and a 4 ha in Sulawesi. Approximately 95% of the total area of seed orchards (approx. 628 ha) are seedling seed orchards to be converted from progeny tests. Selection of families or individuals has not been practised yet. Thus the seed quality will not be good due to the related matings among half-sib individuals which are planted neighboring each other unless proper thinning will be carried out.

② Seed stands

Seed stands with five species of *acacia mangium*, *leucaena leucocephala*, *aleurites molucana*, *keruing* and *meranti* are located at ten places, a total area of 1,862 ha. There are no written criteria for selection of those seed stands (Annex 14).

③ Seed production area

For seed production areas including natural forests, 3,430 ha have been designated in 19 regions. In addition to the already designated breeding species, 13 species including *morukka-nemu*, *ooba-mahoganii*, *nan'you sugi* and *agathis* have been designated (Annex 15).

④ Provenance tests etc.

Provenance tests were conducted using seeds collected by, elevation or island, or imported seed lots in the case of *eucalyptus*. For *pinus merkusii*, *pinus caribaea*, *teak*, *A. mangium* and *eucalyptus*, provenance tests were conducted at 14 places, a total of 28 ha. In addition to these, several kinds of species were tested at four places, a total of 10 ha (Annex 16).

(2) General situation of forestry research

Research on forestry is conducted at the Forestry Experiment Station and the Forest Product Testing Laboratory, both affiliated with the Forestry Research and Development Agency, Ministry of Forestry, (both located on Java). However, no publications describing tests or experimental results are issued as Indonesia has neither academic societies nor associations. At present, the Ministry of Forestry is contemplating the establishment of a Forestry Experiment Station on the main islands.

The detailed results of forestry research conducted at universities are also unclear. Gadjah Mada University has since long been conducting research on tree improvement of several species and has achieved effective results to a certain extent through provenance tests and breeding plantations. However, basic research in the field and laboratory which is required for efficient promotion of tree breeding activities, is yet to be conducted. These basic research results will fully support the activities and development of its field.

2-3 Outline of Supporting Organizations

2-3-1 Organizations of the Ministry of Forestry

The organizations of the Ministry of Forestry of Indonesia and technological bodies and executing bodies are as shown in Annex 17.

2-3-2 Present Status of Supporting Bodies

(1) Administrative bodies governing tree breeding

Both the Bogor Seed Technology Center and Seed Source Development Center Project are directly affiliated to the Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry, and the Seed Production Testing Centers located at three places throughout the country are affiliated to their respective Regional Forest Administration Offices.

① Seed Source Development Center

The Seed Source Development Center was established in 1985 at Kaliurang, the special municipality of Yogyakarta, and performs the development of techniques for the cutting, grafting and layering of several species, and that of tissue culture technology. Furthermore, there are plans for the establishment of a clone bank and a breeding (hedge orchard) plantation, and selection and reevaluation of superior trees. At present, breeding activities are not positively promoted due to the lack of facilities and researchers. This organization is to be absorbed into the Center under the Project after its completion.

② Seed Technology Center

The Seed Technology Center is located in Bogor, West Java, and conducts the selection of seeds. Its activities include neither tree breeding nor the development of breeding technique. In 1992 when the Center of the Project is completed, this organization will be transferred to the Sub center.

③ Seed Production and Testing Centers

Three Seed Production and Testing Centers are located in Bandung, West Java, South Sumatra and South Sulawesi. The activities of these centers focus on the collection, storage and distribution of the seeds of existing industrial tree species. The center in Bandung will have its functions absorbed into the Seed Technology Center after it has been converted into a subcenter. The other two centers in South Sumatra and South Sulawesi will be converted into subcenters in 1992 after the Center of the Project has been completed.

④ Gadjah Mada University

This university is not related to the Directorate General of Reforestation and Land Rehabilitation, but has cooperative relationship with it. The university's Faculty of Agriculture has since 1976 been engaged in conducting research on the genetic variation and breeding of *pinus merkusii* and achieved good results. The university has a professor specializing in tree breeding, and she is cooperating in the research on genetic breeding and in the development and promotion of breeding techniques. She has also sent her students to Japan to attend a seminar on tree breeding at the Tsukuba University and a seminar on forestry at the Hokkaido University. The university is located in Jogjakarta, in the vicinity of the Center of the Project, providing great convenience for joint research.

Currently, these four organizations involved in tree breeding have no opportunities for official conferences or cooperation with the Ministry of Forestry, with regard to the promotion of tree breeding.

(2) Forestry educational institutions

Of the forestry educational institutions related to the Project, the universities with Faculties of Forestry are Bogor University of

Agriculture (IPB) and Gadjah Mada (UGM) in Java, and Mulawarman University (UNMUL) in Kalimantan. The former two universities have good standing and long tradition, and have important positions in government organizations. All these three universities are under the control of the Ministry of Education and Culture (P&K).

2-4 Evolution and Details of the Request

(1) Evolution of the Request

In his address to the Diet on August 16, 1989, President Suharto referred to the forestry in Indonesia as follows (limited to the relevant parts):

"Protecting the functions of natural resources completely and maintaining the perpetuity of the natural environment is our responsibility, and doing this will serve not only the interests of the people living in the present age but also of the future and the future generations. - Ellipsis - In particular, in the management of our tropical forests, we seek those advanced countries which will be willing to carry out reforestation activities with us for expansion of our tropical forests to 20,000,000 ha. The Republic of Indonesia sets aside the fund of US\$300,000,000 every year for reforestation activities to restore 300,000 ha of forest every year. However, if we must do this on our own, we need another 65 years until we can cover 20,000,000 ha with forest. - Ellipsis -."

Based on these circumstances, the government established a plan for industrial reforestation of 4,200,000 ha in the 4th to 6th National 5-year Development Plans (over a period of 15 years from 1984 to 1998) and thereby positively promoted reforestation activities. The government has also taken necessary measures such as the provision of a supporting technology center, based on the premise that establishing a system for production and supply of superior seeds and saplings is essential for the smooth and efficient implementation of the plan.

However, as the government is suffering severe financial distress, it cannot afford funds for the construction of new, essential facilities and the purchase of supporting equipment and materials, nor to supply manpower for the improvement of technical levels in this field. Consequently, the government requested the Government of Japan to send three experts with specific expertise to Indonesia

in September 1988, and in March 1989 further requested Japan's grant aid and technical cooperation for the Project.

(2) Details of the Request

The details of the request from the Indonesian Government for Japan's grant aid for the establishment of the Forest Tree Improvement Development Center (FTIDC), which were confirmed by the team, are as outlined below.

① Objectives of the Project

The objectives of the Forest Tree Improvement Development Center include the following:

- i) Genetic modification of select tree species and production of seeds from the modified species.
- ii) Development of breeding techniques.
- iii) Management of breeding related information.

② Location of project site

Pelem Dusun, Purwobinangan Desa, Pakem Kacamatan, Sleman Kabupaten, Yogyakarta Propins.

③ Project executing agency

Directrate of reforestation and regreening, Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry.

④ Project key facilities and equipment

Main building facilities, workshop for wood, artificial fertilization building, other support facilities, laboratory equipment, equipment for field work, information control equipment, vehicles and other transportation equipment.

SECTION 3 OUTLINE OF THE PROJECT

- 3-1 Objective**
- 3-2 Study and Examination of the Request**
- 3-3 Project Description**
- 3-4 Technical Cooperation**

SECTION 3 OUTLINE OF THE PROJECT

3-1 Objective

The objective of the Project is to build a Forest Tree Improvement Development Center with its scheduled activities centering on the development of forest tree breeding techniques, collection of seeds from existing tree species, production of superior seeds from genetically improved trees, and management of breeding-related information, as well as providing equipment required in connection with promoting the above-mentioned activities, in order to promote effective industrial reforestation activities.

3-2 Study and Examination of the Request

3-2-1 Study of Project Adequacy and Necessity

The Indonesian Government has set out the project details as follows:

- 1) Supply of seeds for use in industrial reforestation,
- 2) Promotion of tree improvement, and
- 3) Management of breeding-related information

The adequacy and necessity of the above-mentioned project details are as considered below.

- 1) Supply of seeds for use in industrial reforestation

The supply of sufficient seeds to meet the amount of seedlings required for the planned reforestation acreage is essential to promote the smooth progress of state-led industrial reforestation. As described in 2-2-2 (2), the government has a plan for the industrial reforestation of 4.2 million ha and greening of 8.5 million ha over 15 years during the 4th to 6th 5-year Plans, but it seems that this target will be difficult to achieve in view of the already accomplished results. One of the causes of the large difference between the size of the planned area and the actual reforested area lies in an insufficient supply of seeds, hence it

would be desirable for the country to have a facility capable of furnishing a large quantity of seeds for reforestation.

The promotion of industrial reforestation has been carried out with the aim of supplementing the natural forests being progressively exploited at present, from the viewpoints of environment and resources. The seed supplier must give consideration to the success and profitability of reforestation and their future gain at the final harvest. Twenty species are used in the current industrial reforestation covering the regions of Sumatra, Kalimantan and Irian Jaya. In order to properly promote reforestation using the various species in diverse environments, it is necessary for Indonesia to have an organization which can conduct species adaptability tests and provenance tests consistently, and the results of the trials should be reflected in the choice of species or seed sources for each region.

As stated above, the Forest Tree Improvement Development Center should be given the functions of collecting, storing and distributing seeds, thereby directly contributing to the supply of seeds for use in industrial reforestation while, on a medium-term basis, contributing to the proper execution of the reforestation plan through conducting species adaptability tests and provenance tests, and designation of species and supply of seeds for each region based on analysis results. Furthermore, on a long-term basis, provenance tests should be carried out as they are regarded as the foundation for the tree breeding described in the subsequent paragraphs.

Thus, the request from the Indonesian Government to provide the Center with the above-mentioned functions can be regarded as appropriate, and such a center will greatly contribute to the progress of industrial reforestation.

2) Promotion of tree improvement

In order to support the reforestation activities of Indonesia on a long-term basis and heighten its achievements, forest tree improvement activities would be an integral factor. While

designation of seed sources based on provenance test results, etc., is limited to a mere selection from among existing seeds, tree breeding activities include the selection and creation of optimum seeds, which can then be supplied to the reforestation bodies. Conversely, through the establishment of seed orchards and scion gardens using genetically improved trees, seedlings for reforestation can be guaranteed both quantitatively and qualitatively.

As the required extent of progress for tree improvement for reforestation varies by species and region, it is necessary to deal with it at the level of improvement. Improvement of *eucalyptus europhylla*, *pinus merkusii*, etc., has proceeded on Java to provenance/progeny tests. For these species, conditions are suitable to establish provenance tests for places other than Java, conversion of these tests into seed orchards, selection of plus trees, and crossing of trees towards the second generation. On the other hand, for the *shorea* spp designated as one of the important species in Indonesia, research should be started with the collection of basic information on flowering and seed handling. During the basic design study, ten species including the three mentioned above were selected from among the species for use in industrial reforestation as promising species based on past reforestation results. Progress in tree improvement is in most cases among the above-mentioned two groups.

In many species, tree improvement starts from provenance tests, then it proceeds to breeding by selection aiming to increase productivity. In case improvements in wood quality or tolerance to diseases and insects are necessary, cross breeding may be employed in correspondence to the genetic mechanism of the target trait.

Research on the application of these methods to each species will be undertaken at the Center on a semi-commercial scale, then commercial-scale seed production will be carried out at the individual subcenters scheduled to be established in the future. Each subcenter will handle the species which are suited to the region involved, as described in the request.

Thus, the request from the Indonesian Government for providing the Center with the above-mentioned functions regarding the tree breeding area are appropriate as a whole, and the Center will contribute greatly to the development of Indonesian industrial reforestation through tree breeding activities.

3) Management of breeding support information

In order for the Center to produce the seeds of existing stands and genetically improved trees as well as develop tree improvement techniques adaptable to the country, it is essential to establish a comprehensive system for performing the collection, storage, analysis and transmission of breeding information. However, until the development of tree improvement activities in Indonesia becomes full-fledged, the amount of information on tree improvement will not be large and not so urgently needed for actual use. Difficulties also exist in dealing with software, including the construction of a data base system, though hardware development advances rapidly, hence information processing by means of a personal computer is realistic. However, as future data exchange between personal computers in the Center is a definite possibility, it will be necessary to establish the environment for the creation of an in-house LAN system.

3-2-2 Study of Activity Operation Program

(1) Activity divisions and staffing program

The activity divisions and their roles in the Project, which have been specified by the Indonesian Government, are as listed below, and are appropriate in view of the planned functions of the Center.

① General Affairs Division

A division responsible for conducting general administrative office work. (14)

② Planning & Coordination Division

A division responsible for the planning/ coordination of tree breeding activities, guidance/investigation, and collection of statistics. (12)

③ Breeding Research Division

A division responsible for conducting genetic improvement of seeds, development of breeding techniques, and research/development. (23)

a. Breeding/Testing Laboratory

A laboratory responsible for conducting research on development of techniques for selection, crossing, (tolerance, wood improvements), and testing. (8)

b. Propagation Research Laboratory

A laboratory responsible for conducting seed orchard management and development of techniques for multiplication and production. (6)

c. Data Processing Laboratory

A laboratory responsible for conducting development of techniques for collection, storage, analysis and transmission of data on breeding information. (6)

④ Field Management Division

A division responsible for the management of seed storage facilities and execution of field work at outdoor nurseries and breeding plantations. (12)

The Indonesian Government has tentatively chosen staff and managers for the individual divisions mentioned above, (Annex 18), and such staffing can be considered sufficient to execute the above-mentioned activities.

(2) Budget Planning

To provide for work and operation costs that the Indonesian Government must bear during the construction period of the Center and during its operation phase, detailed measures have been decided as described below.

- ① A budget for execution of the Project will be appropriated from the state budget, and has already been approved by the Agency of State Development and Planning. The approved budget is included in the State Development Blue Book, hence is no problem.
- ② In addition to the state budget, the Ministry of Forestry has revenues from Reforestation Fund (DR) levies, which was enforced from July 1, 1989, and is wholly responsible for its operation. This Reforestation Fund levies a charge of 7 dollars per cubic meter of trees felled from a state forest, and had a balance of approximately Rp 600,000,000,000 as of the end of March 1989.
- ③ In addition to the measures noted above, an operation cost of Rp 225,000,000 per annum, which has been given to the Seed Source Development Project in Kaliurang, will be transferred to the Center as part of its operation cost.

Based on the foregoing, it is considered that the Indonesian Government has sufficient budgetary means to cover the required costs for the construction and subsequent operation of the Center.

3-2-3 Study of Duplication with Similar Projects

The Directorate General of Reforestation and Land Rehabilitation is the only agency wholly responsible for grant aid extended for the breeding area in question from Japan and other foreign countries. Previous grant aid (Annex 19) includes:

- ① Technical cooperation from various countries for seventeen projects including the Reforestation and Agricultural Development Project for the basin of the Cimanuk River (ADB-762 INO Port B).
- ② Technical cooperation from Japan for five projects including the Sulawesi Region Agricultural Development Project (December 23, 1976 ~ May 23, 1982).
- ③ Research on development by Japan for six projects including the Kalimantan Forest Development and Port Construction Project (1970).
- ④ Basic design study on a grant aid basis from Japan for five projects including the establishment of the Reforestation Technology Institute of Mulawarman University (1978).

None of these projects is duplicated by the Center, which is partially intended for carrying out genetic improvement, hence there should not be any obstructions to the achievement of its objective.

3-2-4 Study of Request Facilities and Equipment

The following describes the results of examinations of the plan for the activities by and technical cooperation from Japan for the proposed Center.

(1) Main Building

The requested facilities comprise the divisions involving general affairs, planning and coordination, breeding research, field management, and other support facilities.

Four of these divisions correspond to the key activities of the Center, hence can be deemed appropriate. All other facilities should be limited to the minimum scale required for execution of the Center's activities for a period of five years.

Therefore, facilities involving morph-wood, tissue culture and information control have been scaled down from the original request

as they should be considered along with the progress of technical cooperation. Also, the AV room has been reduced to the size of a conference room as it will not be directly handled by the Center.

Based on the above-mentioned points of view, the four divisions which constitute the Center will require the main rooms as listed below.

① General Affairs Division

Head's office, general office, reception room, conference room, etc.

② Planning and Coordination Division

Planning and coordination office, meeting room, seminar room, etc.

③ Breeding Research Division.

a. Breeding and Testing Section

Breeding/testing laboratory, morph-wood laboratory, chemical laboratory, darkroom, seed and pollen storage, etc.

b. Propagation Research Section

Propagation laboratory, tissue culture laboratory, chemical laboratory, etc.

c. Data Processing Research Section

Data processing laboratory, seminar room, etc.

④ Field Management Division

Field facilities such as seed storage room, seed orchards, scion gardens, breeding orchards, clone bank, nursery, exhibit plantation, etc.

(2) Orchard facilities

① Repair shop, ② greenhouse, ③ garage and ④ seedbed and breeding plantation are the orchard facilities which were confirmed by the team. These facilities are vital to the activities of the Center. However, as their details were unclear, the team had discussions with the Indonesian Government on the following details as proposed by the team, and obtained the government's agreement.

	Facility	Reason for necessity, and function
1	Artificial cross breeding building	To carry out artificial crossing under controlled conditions of temperature, humidity, solar radiation, wind strength, etc., and to conduct research on crossing conditions and methods.
2	Cone drying room	To conduct the seasoning and degranulation of cones.
3	Weather recording facility	To conduct the recording of weather conditions on agricultural land such as nurseries.
4	Semi-greenhouse with misting apparatus	To carry out work on multiplication, such as cutting, layering, etc.
5	Workshop	To prepare potted seedlings.
6	Chemicals storage	To conduct the storage, handling and classification of agricultural chemicals.
7	Equipment and tool warehouse	To store agricultural tools and equipment.
8	Workshop building for wood.	To carry out the fabrication of test pieces for wood quality tests, nursery fixing frames, and containers for potted seedlings.
9	Specimen storage	To carry out the storage and preparation of specimen trees for verification, and test materials for nursery fixing frames.
10	Workers' room	A relaxation facility for field workers.
11	Miscellaneous	Garage, oil storage, pump house, generator room, substation.

(3) Equipment

All pieces of the requested equipment are basically essential to the activities of selected breeding, cross breeding and provenance tests, and are considered as generally reasonable. However, it was decided to limit information control equipment, tissue culture laboratory equipment and morph-wood laboratory equipment to those essential for five years of activities.

3-2-5 Basic Policy for Execution of the Project

The results of considering the above matters relative to the execution of the Project indicate that the request from the Indonesian Government is appropriate, realistic and adequate for the intended purpose, and that the government is ready to receive Japan's grant aid and has the ability to operate the Center after its completion. Therefore, the Project will meet the objectives of the Grant Aid System of Japan described later in SECTION 5, and it is judged that the implementation of this grant aid is appropriate. However, it has been decided to limit some of the activities to those essential for 5 years of operations, as described earlier in this section.

3-3 Project Description

3-3-1 Executing Agency and Operational Structure

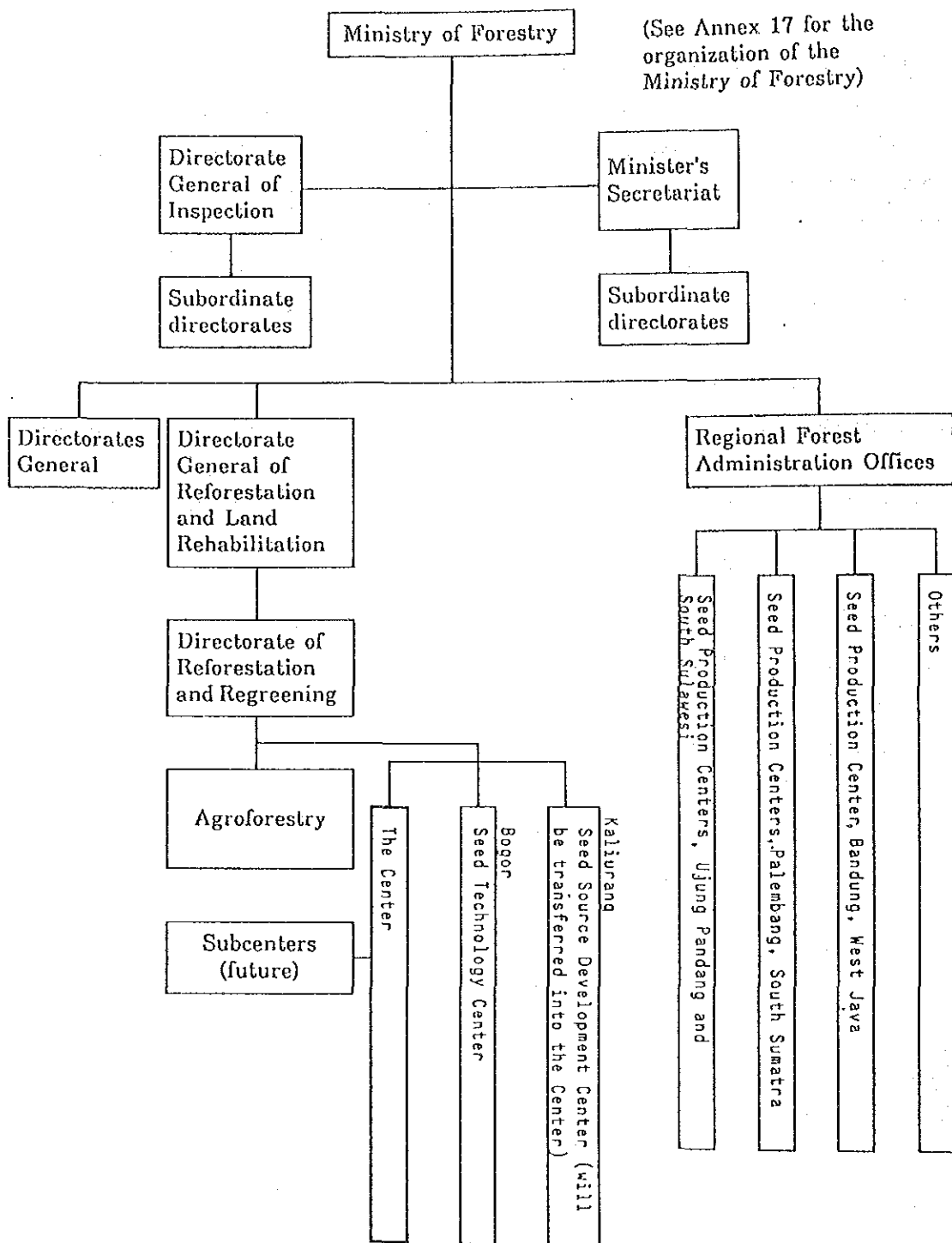
After completion of the Center under grant aid from Japan, its operation will be carried out by the executing agencies and the operating system as follows.

(1) Key executing agency and directly responsible office

(a) Key executing agency : Directorate General of
Reforestation and Land
Rehabilitation

(b) Directly responsible office: Directorate of Reforestation
and Regreening

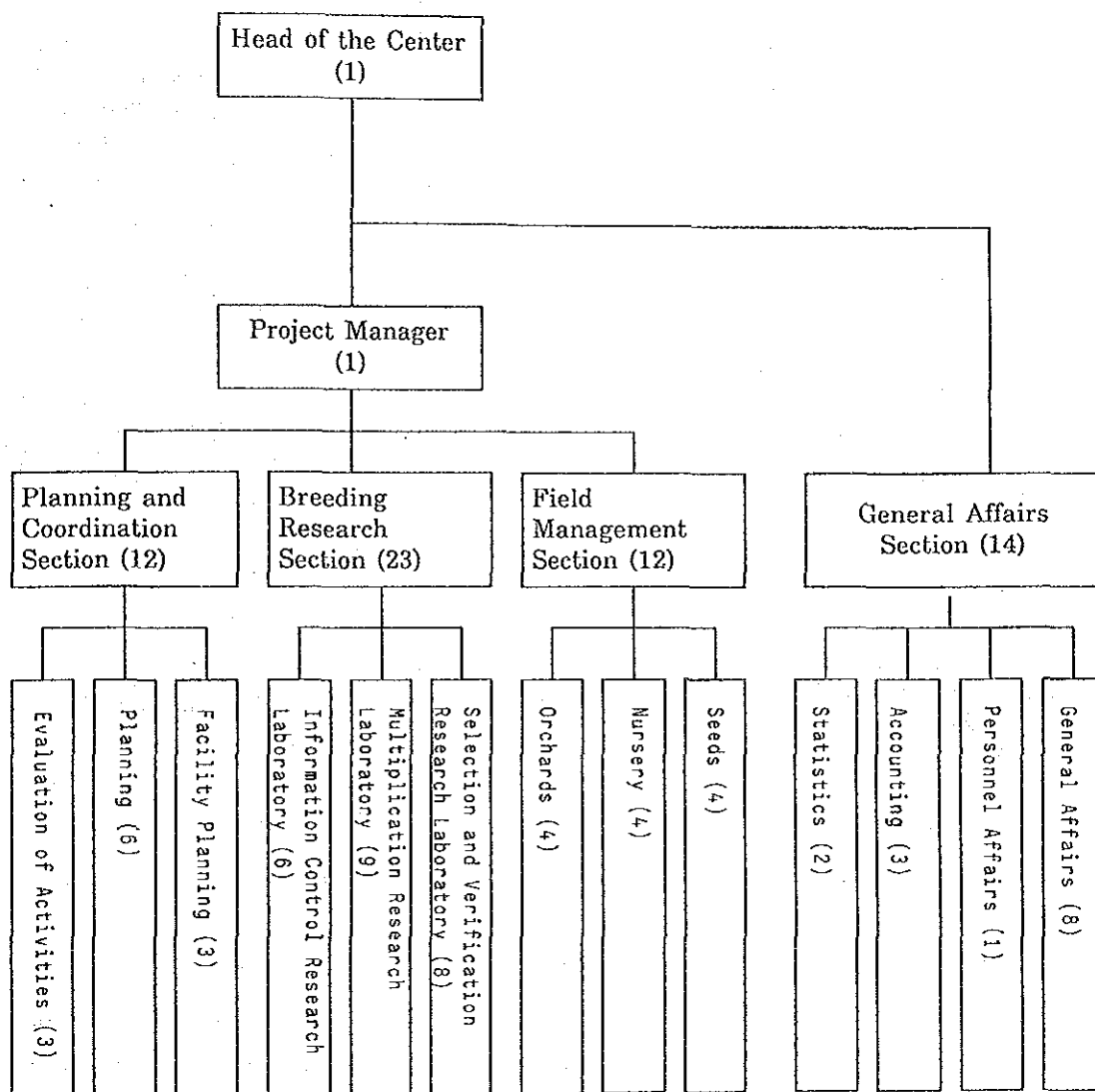
The organizational relations with the Center are as shown below.



(2) Operation system and staffing of the Center

The operation of the Center will be conducted by the following organization headed by the Project Manager (reporting to the Head of

the Center) as leader, and composed of four sections with respective staff in charge as follows:

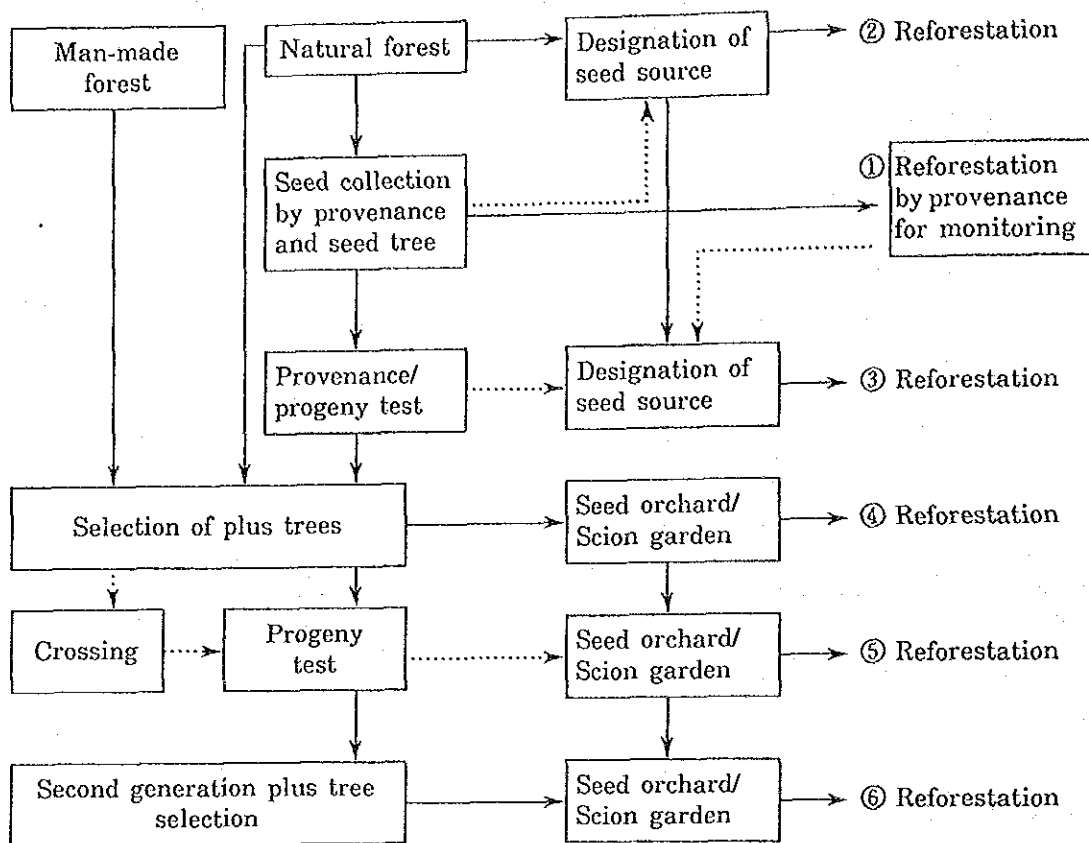


- Note: ① Figure in parentheses denotes the planned number of staff, a total of 62.
 ② Staffing by division is shown on a separate sheet (Annex 18).

3-3-2 Planning and Schedule of Activities

(1) Planning of activities

The process contributing to the augmentation of Indonesia's industrial reforestation, by promoting the activities of the Center, will be as outlined below:



The chart above represents the process of improvement for reforestation seeds applicable to any tree species, in a time series from top to bottom. Each of the work items following "man-made forest" and "natural forest," shown at the top left of the chart, is the actual means for the improvement of reforestation seeds. "Designation of seed source" and each "seed orchard/scion garden" item, located in the center of the chart, are the methods of production of plantation seeds. The items shown on the right hand imply that the seeds produced by the method suitable for the individual stage improvement are used for actual reforestation.

The numbers coming before "reforestation" denote that genetic improvement is greater with higher numbers. The numbers ① ~ ③ represent the stages of supply for genetically improved seeds selected from among the existing seed sources based on the provenance tests. As the absolute amount of reforestation seeds is deficient at these stages, the seed storage facility of the Center will be used to store the seeds collected from the Center itself and

other related agencies, and distributed to individual nurseries, thereby contributing to an efficient utilization of reforestation seeds. In the period ④ ~ ⑥, the Center will provide seeds and tree pieces through conducting tree breeding activities for plus trees.

At the Center, "seed collection by provenance and tree," "provenance test," "selection of plus trees," "crossing" and "progeny test," all shown on the left-hand side of the chart, will have their actual methods defined by tree species, and necessary activities will be carried out in linkage with the subcenters and the regional agencies of the Ministry of Forestry. "Seed sources," shown in the center of the chart, will be designed according to the results of provenance tests. On the other hand, for seed orchard/scion garden, the Center will establish a model seed orchard/scion garden in the neighboring national forest for the development of technology for practical use. Following establishment of the technology, it will be transferred to the subcenters for the full-fledged production of seeds.

The species suggested for improvement by the Indonesian side are as shown below:

1. *Shorea spp* : *Shorea leprosula*
2. *Agathis spp* : *Agathis loranthifolia*
3. *Eucalyptus deglupta* :
4. *Eucalyptus europhylla*
5. *Pinus merkusii*
6. *Acacia mangium*
7. *Acacia auriculiformis*
8. *Swietenia macrophylla*
9. *Paraserianthes falcataria* (*Albizia falcataria*)
10. *Dryobalanops spp* : *Dryobalanops aromatica*

Although as described in 3-2-1 the progress of genetical improvement considerably varies with species and regions, it can be considered that the improvement of any species will proceed basically in the order shown on the preceding chart. However, it is necessary to assess the actual situation by species and region,

through the cooperation of the Indonesian side, to clarify which aspect of technical cooperation with Japan should be commenced first.

(2) Schedule for execution of activities

The table below shows the breakdown of activities which are judged feasible for execution in the first five years following the opening of the Center.

Activity	Year of execution						Executing agency
	1st	2nd	3rd	4th	5th	From 6th year on	
1. Preparation of written programs on seed production and breeding activities							①
2. Improvement of existing seed stands and seed orchards							① ②
3. Collection, storage, quality testing and distribution of seeds from existing seed forests and seed orchards						---	③
4. Selection of plus stands as new seed sources							①
5. Selection of plus trees							① ② ③
6. Multiplication (cutting and layering) of plus trees						---	① ②
7. Provision and execution of breeding						---	①
8. Establishment of clone banks, seed orchards, scion gardens, breeding orchards						---	③
9. Establishment of progeny tests and analysis						---	① ② ③
10. Development of technique for early testing						---	①
11. Processing of information on seed production, breeding activities and techniques						---	①

Legend : ① The Center ② Subcenter ③ Related agency

As mentioned above, the degree of progress in the improvement of species greatly differs according to species and regions, hence various activities will proceed simultaneously and/or in parallel. Namely, in the case of *eucalyptus europphylla* and *pinus markusii*, their progeny tests/provenance tests have already been carried out on Java, so it is feasible to commence the various types of work at an early time, such as the establishment of progeny tests (9) other than on Java, the conversion of the progeny tests into a seed orchard (2), as well as the selection of plus trees (5). Furthermore, it is feasible to commence the crossing of these species towards the second generation and the development of an early testing technique (10) in the latter period. For the exotic species such as *acacia*, and other species whose improvement has not been commenced yet, it will be essential to secure seed sources as well as to establish provenance tests (9) at an early date.

Of the activities mentioned above, the selection of plus trees (5), which should be carried out extensively, and the progeny tests/provenance tests (9) can be programmed at the Center, but the involvement of the subcenters and the regional agencies of the Ministry of Forestry is essential to their establishment and survey. Similarly, it will be necessary to set up a linkage with the subcenters at an early time for the improvement of existing seed orchards (2), seed collection (3) and the multiplication of plus trees (6). However, regarding the preparation of programs (1) and the designation of seed sources (4), it would be preferable for the Center to carry out these tasks independently. As crossing (7), early testing (10) and data processing (11) are new operations, it would be more advisable to proceed with the development of technology under the leadership of the Center.

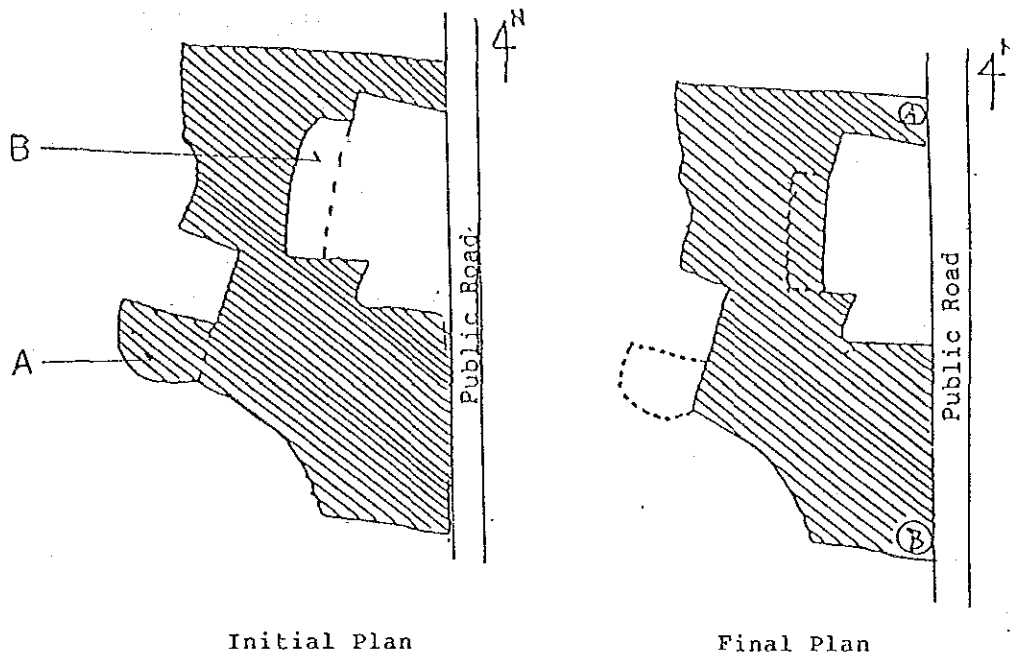
In the commencement of the technical cooperation, the details of activities should be more sophisticatedly classified to distinguish the responsible scopes of the various government interests, based on the ideas mentioned herein and with the cooperation of the Indonesian side. It is also necessary to program a detailed implementation schedule of activities by subject species and region.

3-3-3 Location and Condition of the Project Site

The following outlines the location and topography of the Project site, the status of its surroundings and the extent of infrastructure available.

(1) Outline of Project Site

- ① Location : Pelem Dusun, Purwobinangan Desa, Pakem Kacamatan, Sleman Kabupaten, Yogyakarta Propins
- ② Area : 5.5 ha
- ③ Distance from the city center : Approximately 12km north of the center of Jogjakarta.
- ④ Land category : Sugar cane plantation.
- ⑤ Existing conditions : Sugar cane plantations are located over about five different grades, gradually sloping from the north.
- ⑥ Grade : A grade of approximately 10 meters (a 3% gradient) from the north end of the site to its south end.
- ⑦ Soil : The top layer is composed of humus soil, and the lower layer composed of gravel containing volcanic ash. The humus soil in the top layer is good for planting, and therefore it will be necessary to prepare the site in such a way as to minimize damage to it.
- ⑧ Groundwater level : Located at a relatively high level (70 ~ 80cm), is underlaid by an impermeable layer composed of gravel.
- ⑨ Topography : As described below.



While the team was conducting site investigations, it was found that the point A (the site originally scheduled for purchase) could be exchanged for the point B, both shown on the drawing above, and the team agreed to that proposition. The point B site offers a better topography for the Project.

(2) Overview of infrastructure

- ① Electricity : Although there is a high voltage branch point located 1.5 km north of the Project site, there is no 3-phase 380 volt high voltage transmission line available for the Center.
- ② Water supply : Deep well water, at a rate of approx 55m³/day, will be consumed by the Center's main building, its support facilities and for sprinklers at orchards.
- ③ Drainage : Drainage will be discharged into the existing irrigation channels running through the site and at its boundary.

- ④ Gas : There is no city gas supply around the site nor is there any future plan for its provision. Therefore the Center will use propane gas.
- ⑤ Telephones : Telephone wiring will be installed by not later than December 1991 (the time for the completion of the Center).

3-3-4 Outline of Facilities and Equipment

The facilities, equipment, functions and scales that can be regarded as reasonable in the light of the planned activities of the Center, are as given below.

(1) Facilities

① Main building	<p>A 2-storied reinforced concrete building with a total floor area of 2,585.66 m².</p> <p>Function : To draft plans for the promotion of breeding activities with the aim of improving productivity, tolerance of trees to harmful insects and materials, and to conduct the development of techniques involved.</p> <p>Key rooms: Head's room, meeting room, office room, laboratories for chemical analysis and tissue culture of seeds, pollen, morph-wood, library and darkroom.</p>
② Workshop for wood	<p>A single-storied reinforced concrete and brick building with a total floor area of 280.0m².</p> <p>Function : To prepare specimens for wood quality tests, and their storage.</p> <p>Key rooms: Laboratory material preparation room, material storage, chemicals storage.</p>

③ Cross breeding building	<p>A single-storied steel building with a total floor area of 155.5m².</p> <p>Function : To conduct artificial crossing under given conditions and to examine crossing conditions and methods (subject trees: grafted trees and young trees).</p> <p>Key rooms: Supervision room and preparation room.</p>
④ Cone drying room	<p>A single-storied reinforced concrete and brick building with a total floor area of 86.9m².</p> <p>Function : To conduct cone drying and extraction of seed from cones.</p> <p>Key rooms: Cone drying room.</p>
⑤ Open cone drying yard	<p>A concrete floor.</p> <p>Function : To conduct cone drying and extraction of seeds.</p>
⑥ Semi-greenhouse with workshop and misting apparatus	<p>A single-storied light-gauge building with a total floor area of 330.0m².</p> <p>Function : To provide cutting beds with mist for propagation of cuttings.</p>
⑦ Worker's relaxation building	<p>A single-storied concrete brick building with a total floor area of 102.4m².</p> <p>Function : A relaxation building for 20 ~ 40 field workers.</p> <p>Key rooms: Relaxation room and flush toilet.</p>
⑧ Pump house	<p>A 27.5m² single-storied steel house.</p> <p>Function : To accommodate a deep well pump.</p>
⑨ Oil storage	<p>A 12.0m² single-storied steel house.</p> <p>Function : To refuel vehicles with gasoline and oil.</p>
⑩ Garage	<p>A single-storied concrete and steel building with a total floor area of 105.2m².</p> <p>Function : To accommodate various vehicles for orchard management.</p>
11 Generator and substation building	<p>A single-storied concrete and steel building with a total floor area of 104.0m².</p> <p>Function : To supply electricity to the facilities of the Center in the event of a power outage.</p>
12 Gas bottle storage	<p>A single-storied brick shed.</p> <p>Function : To supply propane gas to the laboratories and hot-water service room in the main building.</p>

(2) Equipment and apparatuses

- ① Laboratory equipment
Function : Research on seeds, asexual reproduction of plants (including tissue culture), morphogenesis and material characteristics, and chemical analysis of specimens (including analysis of isozymes)
Major equipment : Ultra low-temperature seed and pollen storage cabinet, isozyme analysis apparatus, tissue culture device and equipment, weak radiographic camera, woodworking machine for preparation of material specimens, etc.
- ② Equipment for field survey
Function : Equipment mostly comprising measuring devices required for field surveys on seed orchards, provenance tests, and selection of plus trees.
Major equipment : Poles, cameras, increment borer, etc.
- ③ equipment for field operation
Function : To conduct the management of nursery, seed orchard, breeding orchard.
Major equipment : Service equipment for use at elevated locations, tractor, etc.
- ④ Information processing equipment
Function : To conduct the exchange of data, mainly by personal computers, on information of breeding, etc., until full-fledged development of tree seed and breeding activities.
Major equipment : Personal computers.
- ⑤ Weather observation equipment
Function : To observe atmospheric conditions over orchards, such as nurseries, and in the cross breeding building.
Major equipment : All-weather type data measuring recorder and instrument shelter.
- ⑥ Vehicles
Function : To transport test samples, field equipment and workers.
Major equipment : Light vans, wagons, minibuses, pick-ups, jeeps, etc.

3-3-5 Maintenance Plan

After completion of the Center, the following system and expenses will be required for the maintenance and control of the Center.

(1) Maintenance and control system and method

For the adequate functioning and maintaining of the facilities for a prolonged period, personnel specializing in maintenance and control systems should be ensured. However, as the staffing plan for the Center includes no such special assignment, support systems and methods should be set up in consideration of the following items:

① Ensuring experienced staff for facility maintenance and control

Experienced staff should be assigned to the maintenance and control of the facilities of the Center, and should be given education and training with regard to the following points:

- a. Building engineers, mechanical engineers and electrical engineers should attend equipment explanation meetings and various inspections to take place during the construction period of the Center, so that they build up practical experience.
- b. They should be capable of perceiving in advance any and all possible faults of the buildings and installed systems after completion of the Center.
- c. They should thoroughly understand the details of daily maintenance and inspection services, and should familiarize themselves with how to deal with them.
- d. They should thoroughly understand the methods for inspection and servicing of the equipment as per the operating and maintenance instructions (provided by the contractor) of each piece of equipment, so that they can perform inspections and servicing without error.
- e. During the construction period, they should hold discussions with the consultant on the method of dealing with an emergency to set up a proper countermeasure system.

f. Proper maintenance and control largely depend on a thorough understanding of the design intent and conditions as per the design documents. Therefore, personnel should endeavor to understand the design details throughout the construction period.

② Ensuring expendable supplies

a. All expendable supplies and equipment parts required by the electrical, plumbing and mechanical installations will be procured in Indonesia. Therefore, these locally-procured items should be accompanied by proper lists specifying model numbers, agents, their addresses, persons in charge, and other necessary information, as well as a contact system, and a supply verification system based on such lists should be established.

b. All warranties, lists of expendable supplies, parts lists, etc., which will be furnished by the contractor upon completion of the Center, should be stored for use whenever required.

(2) Equipment maintenance and control systems

In order to maintain the functioning of laboratory equipment and working equipment, it is necessary to establish a system for the prompt rectification of failures and permitting daily maintenance and control, as well as a system for continuous replenishment of spare parts and expendables, so that no equipment is left inoperable due to improper systems and methods. Engineers for exclusive assignment should be stationed at the Center as well.

① Maintenance and control system

As most of the equipment which will be installed in the Center is not produced in Indonesia, it will be procured from Japan. For the maintenance of such equipment, neither public nor

private sectors have sufficient repair staff, facilities or equipment. Such a situation suggests that it would be difficult for the Center to have its own maintenance and control division, so it would be desirable for the Ministry of Forestry or the Directorate General of Reforestation and Land Rehabilitation to incorporate the maintenance and control system of the Center into that of their own. Basically, it should be planned for exclusive assignment of as many maintenance and control staff as possible for exclusive service to the Center in the course of drafting a staff plan.

② Countermeasures for initial troubles with equipment

Equipment operators and technological staff cannot avoid making mistakes in the beginning, and malfunctions attributable to such mistakes as well as initial trouble in the first year after commencement of use of the equipment and apparatuses would occur more frequently than in Japan. Most such trouble can be dealt with easily by replacing parts or simple repairs. Therefore, specialist engineers should be appointed at an early stage of the construction period and allowed to attend at the delivery of equipment and participate in the explanation meetings for equipment maintenance and control, so that they familiarize themselves with how to deal with initial troubles.

③ Acquisition of skill in equipment operation and carrying out of daily maintenance and control

Daily maintenance and control of equipment should be performed by the technicians or operators who actually use the equipment, rather than by specialist engineers. In order to prevent maloperation which is the greatest cause of equipment trouble, and so that proper maintenance and control is carried out as per the instruction manual involved, the operation procedures, the operating and maintenance instructions and other equipment manuals involved should be made available for use at any time. At the same time, the specialist engineers should receive sufficient technical instructions from Japanese engineers.

(3) Overview of maintenance and control costs

The costs required for maintenance and control (not including operation costs) are as listed below.

List of maintenance and control costs

(In thousands of Rp)

	Item	First year after opening	2nd year	Remarks
1	Personnel expenses	204,270	214,935	
2	Light and fuel expenses	35,973	37,772	①, ⑥, ⑦
3	Facility improvement cost	33,910	4,105	②, ③, ④, ⑤, ⑨
4	Equipment (for general use) maintenance cost	3,962	4,160	⑩, ⑪
5	Equipment (for laboratory use) maintenance cost	5,766	8,649	④
6	Communication charges	6,975	7,324	⑧
7	Office expenses	25,576	26,855	⑫
8	Equipment maintenance cost	14,700	15,435	⑬
	Total	331,132	319,235	
	Total 2 to 8	126,862	104,300	Personnel expenses and operating expenses excluded.

- Notes:
- In column 5, the equipment (for laboratory use) cost is greater for the 2nd year because some of the parts and spare parts for the main equipment are to be supplied in the first year under the proposed project.
 - Other items include a 5% price increase.
 - Equipment maintenance cost for the first year is included in the cost of the Center.
 - Cost breakdown is given in Annex 20.

With regard to the above-mentioned items, the relationship with the Indonesian maintenance and control plan is as outlined below.

The following is the breakdown of all costs (including the operating cost) spent in 1988 at the Seed Source Development Center in Kaliurang, (not including personnel expenses):

① Office overhead	:	Rp 1,000,000
② Project-related expenses	:	Rp 1,000,000
③ Travel expenses	:	Rp 1,000,000
④ Building maintenance and control expenses	:	Rp 14,000,000
⑤ Expenses for utilities	:	Rp 25,000,000
⑥ Activity operating expenses	:	Rp 158,000,000
⑦ Equipment cost	:	Rp 25,000,000
Total		Rp 225,000,000

The total, less the activity operating expenses, will be Rp 67,000,000, approximately 50% higher than the cost (Rp 126,862,000) for the first year of the Center against the corresponding item. Judging from the fact that, upon completion of the Center, this Seed Source Development Center will be entirely absorbed into the new Center provided through the Project and that its whole cost will be incorporated into the cost budget of the Center, and in view of the Reforestation Fund established within the budget of the Ministry of Forestry, it is very possible for the Center to obtain an additional budget for the increased portion (approx. Rp 30,000,000).

3-4 Technical Cooperation

The Republic of Indonesia has been carrying out industrial reforestation of 4,200,000 ha for a period of 15 years under the 4th to 6th 5-year Development Plans. The request of the Indonesian Government for technical cooperation from the Government of Japan is based on the perception that the stable supply of seeds and having genetically improved superior seeds are necessary for the smooth promotion of the above plans. The details of the request are as outlined below.

(1) Details of technical cooperation

- ① Reconsideration and evaluation of the status of activities conducted by the agencies related to the improvement of existing tree seeds.
- ② Establishment of strategies and detailed plans for the long and short-term improvement of tree seeds.
- ③ Provision of a system for collection, sorting and furnishing of data and information relating to the improvement of tree seeds.
- ④ Transfer of breeding technology.
- ⑤ Planning and implementation of tree breeding.
- ⑥ Technical cooperation on the collection, storage, packing and germination tests of seeds.
- ⑦ Fostering of manpower for engagement in the above-mentioned activities.

(2) Dispatch of specialists

- ① Genetic area, ② seed area, ③ physiological area, ④ breeding area, ⑤ tree measuring area, ⑥ engineers for seed and vegetative propagation, and ⑦ technicians for germination testing of seeds, and ⑧ data processing.

(3) Acceptance of Indonesian trainees by Japan

As mentioned in 3-2-3, currently there is no technical cooperation from any foreign country competing with the proposed project, but there are a few projects with some parts related to or duplicated by the proposed project; for example, in the reforestation project being carried out jointly with Japan in Bunakat, South Sumatra, the nursery methods for various tree species were clarified and species adaptability tests were conducted. In the mechanized nursery and plantation project executed by Finland, mechanized nursery work has been carried out and the provenance tests of species targeted for use at the Alang-Alang Plain have been conducted. These results contain a great deal of valuable technical information for examination in the determination of details for technical cooperation with Japan at the proposed Center. Moreover, the ASEAN-Australia Forest Tree Improvement Program is regarded as a similar project to the proposed project but covering a more extensive range. Therefore it is necessary to precisely assess the evolution of the ASEAN-Australian Project from the position of the Center to use a greater amount of genetic resources.

Also, the progeny tests/provenance tests of *eucalyptus* and *pinus merkusii*, which Gajah Mada University conducted in Indonesia on commission from the Ministry of Forestry, received advice in the design phase from the University of Michigan, U.S.A. Currently, these testing plantations must be in the stage of being converted into seed orchards, and the Ministry of Forestry is currently considering how they should be handled in the future and how to assess the results. Therefore, although how these testing plantations should be handled is specified in the technical cooperation particulars, the actual execution thereof should proceed with the close involvement of the staff of Gajah Mada University and based on a full assessment of the past evolution.

Currently consideration of the details of the request is underway in Japan in the form of project-type technical cooperation.

SECTION 4 BASIC DESIGN

- 4-1 Design Policy**
- 4-2 Study and Examination of Design
Criteria**
- 4-3 Basic Planning**
- 4-4 Construction Execution Program**

SECTION 4 BASIC DESIGN

4-1 Design Policy

Based on the environmental conditions of the project site as well as focusing on the organic, durable and economic requirements called for by the Project, basic design will be conducted according to the following policies.

1) Policy for natural conditions

The city of Jogjakarta where the project site is located is in the equatorial rain zone, with an annual average rainfall of 400 m/m and over. The year is divided into the rainy season and the dry season.

The setting up of proper room humidity and temperature in view of outside temperatures and humidity, provision for rapid drainage of rain, control and thermal insulation of solar radiation, and provision of a lightning earthing system, etc. will be required.

a. Temperature and humidity conditions

The average temperature in this region varies little from 25°C to 29°C throughout the year. In order to maintain a comfortable living space, it will be necessary to provide the entire building with effective, thermal insulation as well as to install an air-conditioning system in the main living rooms of research laboratories, laboratory rooms, etc. The high average humidity of 45% should be taken into account in planning the ventilation of the rooms.

b. How to cope with solar radiation

The Center facilities should be designed to provide good shade and ventilation to deal with tropical heat as well as create a sense of coolness by incorporating stones, tiles, etc. into the floors and walls, thereby creating buildings well adapted to the local conditions.

c. Earthquakes and lightning

Indonesia is a volcanic country in the circum-Pacific earthquake belt, so the the Center facilities will require seismic structural design.

In addition, thunderstorms occur frequently, sometimes causing severe damage, so a lightning earthing facility should be provided.

2) Social conditions

Although recently the country's public peace and order has been improved, it is necessary to consider security measures against theft, so the use of effective locks is required. Also, the local custom that people do not share the same living facility because of social standing, occupational titles, etc., will be taken into account when setting up spaces.

3) Building conditions

In designing the Center facilities and in selecting the equipment required, compliance with the National Building Construction Code of Indonesia is necessary, and therefore various formalities involving the approval of implementation design drawings, application for confirmation of the building plan, interim inspections, final inspections, etc. will be required. Hence, the Japanese party will need the assistance of a local consultant.

4) Use of local contractors, local equipment and materials

Although local contractors have relatively high levels of technical expertise as well as sufficient construction ability, they are short of skilled construction labor.

Except for some roofing materials, structural steel materials and mechanical/electrical equipment, most others can be procured in

Indonesia. Thus, materials acquisition should be based on the policy that local products are used to the maximum possible extent from the viewpoint of maintenance and control of the Center facilities after their completion. Furthermore, the construction method which can be fully used by local contractors will be employed.

5) Maintenance and control abilities of executing agencies

The Center will be composed of the administrative, planning, research, and activity divisions. The Center facilities will be designed so that these divisions are classified by function so they can be easily administered with the entrance hall positioned at the center of the building.

From the viewpoints of maintenance and control costs, energy conservation will be emphasized centering on natural ventilation and lighting. In selecting building materials, priority will be given to the use of low-maintenance, sturdy materials, which are easy to install and control.

The majority of equipment required will be selected so that it can easily be maintained by local suppliers.

6) Policy for planar facilities and grades of equipment

The policy for selection of the facilities and equipment of the Center should be directed towards the following in consideration of the various conditions of the country:

- a. One-sided corridors should be provided to enable natural lighting and natural ventilation.
- b. Functions should be divided by zone to permit easy usage as well as to provide a courtyard, thereby ensuring the shade to be effected by buildings and a comfortable space. Traffic flow lines in the facilities will be short, and easy to use.

- c. The principal structure of the Center should be a reinforced concrete construction which is common type built in the country, with the walls built of bricks.
- d. In order to permit effective research and laboratory activities as well as easy maintenance from the very beginning of the inauguration of the Center, equipment familiar to Indonesian engineers and researchers will be selected.

4-2 Study and Examination of Design Criteria

4-2-1 Configuration of Facilities

The Center will be composed of the following facilities:

① Main Building

- Administrative area : Office, Head's office, reception room.
- Laboratory area : Laboratories (chemical, morphogenic substance, seeds and pollen), darkroom, and laboratory equipment storage.
- Research area : Research rooms (selection and propagation), reading room, meeting room, project leaders' room, and Japanese specialists' room.
- Information area : Information control and research room, library, and book store.
- Others : Dining hall, cloakroom, and relaxation room.

② Support facilities and buildings

Woodworking building, fertilization building, cone seasoning room, workers' room, equipment storage, oil storage, pump house, garage, burnt soil plant, hothouse with misting system, electric generator, and electric distribution room.

③ Orchard facilities

Nursery, clone banks, seed orchard, head orchard, crossing orchard, and display orchard.

4-2-2 Determination of Scale of Facilities

In setting up the scale of the Center facilities, the activity plan and the staffing plan will be compared to the required floor areas established in the Architectural Institute of Japan Collection of Building Design Materials as well as to similar facilities in Japan (such as the Kanto Tree Breeding Center and regional tree breeding centers), and the scale of each room will be calculated on this basis.

(1) Consideration of scale of each room

a. Office space

The scale will be determined by considering the number of persons using the space for office work. Desks will be arranged back to back. A floor area of 18m² will be planned for allocation to each division chief, 8m² to each section chief and 7m² to each office staff member.

b. Sizes of laboratories and research rooms

Based on the layout of equipment and apparatus, optimum floor areas required for the proper functioning of laboratories will be determined.

c. Library space

While the Indonesian Government has a plan to accommodate 13,000 technical books for research use, space for 70% of this, or 9,550 books will be provided.

Fixed high shelf	140 books/m ²
Hand rack	140 books/m ²
Reading seats	3-person type seat x 3

d. Space for managers

Space for managers includes that of the Head's room, project leaders' room, Japanese specialists' room, etc., which will be sufficient to permit execution of office duties, laboratory work and research.

The sizes of other special rooms will be determined in accordance with the layout of equipment.

Considerations of individual rooms according to the aforementioned classification will result in the following:

① Head's room and secretary's room

Function : Rooms in which the head of the center executes his duties and his secretary executes her secretarial duties which include receiving guests.

1 Head

1 secretary

Calculation base: Based on the Architectural Institute of Japan Collection of Building Design Materials, a floor area of 49m² comprising 25m² for use by the Head himself and 24m² as a discussion area (about 15 persons) will be provided in addition to the floor area of another 24m², composed of 7m² for the use of the secretary herself and 17m² for the reception area.

Furnishings :

Head's room ... Desks, chairs, lockers, and glazed cupboard.

Secretary's room Desks, chairs,
lockers, and glazed
cupboard.

② Japanese specialists' room

Function : Execution of laboratory work and research
by five Japanese specialists.

Calculation base: As per the Collection of Building
Design Materials, 7m² per office
staff: 7 × 5 = 35m²

17m² for 3 laboratory tables and 1
workbench.

A total of 52m².

Furnishings : 3 side tables, 1 work table, 5 desks and
chairs, 5 lockers and 5 glassed cupboards.

③ Project leaders' room (for Japanese specialists and
Indonesian specialists)

Function : A room for both Japanese and Indonesian
specialists to carry out their paper work
and hold discussions.

Calculation base: As per the Collection of Building
Design Materials, a floor area of 25m²
for each specialist will be
allocated.

Furnishings : Desks, chairs, lockers, glazed cupboards,
and personal computer stands.

④ General Office, Services Section

Function : Office work involving the administration of the Center's service properties and nurseries, etc.

	<u>Researcher and engineer</u>	<u>Office staff</u>	<u>Total</u>
Seed technology	3	1	4
Nursery	3	1	4
Orchard	3	1	4
Total			12

Calculation base: As per the Collection of Building Design Materials, $18\text{m}^2/\text{division chief} \times 1 = 18\text{m}^2$, $8\text{m}^2/\text{section} \times 3 = 24\text{m}^2$, and $7\text{m}^2/\text{office staff} \times 8 = 56\text{m}^2$, a total of 98m^2 .

Furnishings : 13 desks and chairs, 5 lockers, 6 glazed cupboards, and 1 personal computer stand.

⑤ Office Planning and Coordination Section

Function : Office duties involving planning, coordination, guidance, investigation, and program statistics.

	<u>Researcher and Engineer</u>	<u>Office staff</u>	<u>Total</u>
Planning	2	1	3
Research planning	4	1	5
Program evaluation	3	0	3
Total			11

Calculation base : As per the Collection of Building Design Materials, $18\text{m}^2/\text{division chief} \times 1 = 18\text{m}^2$, $8\text{m}^2/\text{section chief} \times 3 = 24\text{m}^2$ and $7\text{m}^2/\text{office staff} \times 7 = 49\text{m}^2$, a total of 91m^2 .

Furnishings : 11 desks and chairs, 5 lockers, 5 glazed cupboards, and 1 personal computer stand.

⑥ Office, General Affairs Section

Function : Administration and operation of the Center.

	<u>Researcher and Engineer</u>	<u>Office staff</u>	<u>Total</u>
General affairs	2	5	7
Personnel affairs	1	0	1
Accounting	2	1	3
Statistics	2	0	2
	Total		13

Calculation base: As per the Collection of Building Design Materials, $18\text{m}^2/\text{division chief} \times 1 = 18\text{m}^2$, $8\text{m}^2/\text{section chief} \times 4 = 32\text{m}^2$, and $7\text{m}^2/\text{office staff} \times 8 = 56\text{m}^2$, a total of 106m^2 .

Furnishings : 14 desks and chairs, 5 lockers, 5 glazed cupboards, 1 personal computer stand, 1 copier, and 1 fax machine.

⑦ Tissue Culture Sample Preparation Room and Tissue Culture Room

Function : Creation of a medium for tissue culture, preparation of samples of cultivated tissues (anther, embryo, embryonic cones, etc.), and research on tissue cultivation methods for valuable tropical trees.

Furnishings : Chemicals storage cabinets, clean benches, freezing refrigerators, glazed cupboards, work benches, side benches, clean rooms,

air showers, cultivation racks, central benches, lockers, cabinets, high pressure steam sterilizers, and water distillers.

⑧ Chemical Laboratory

Function : Analysis of characteristics of breeding tree species, and difference between families, by means of isozyme, etc.

Calculation base: Based on the arrangement of equipment and apparatus required for the above mentioned functions.

Furnishings : Ice making machine, ice crusher, chemicals storage, heavy metal waste liquid disposal device, glazed cupboard, central bench, side bench, clean bench, lockers, cabinet, and water distiller.

⑨ Selective Breeding Research Room

Function : Research on methods for selection of superior trees from nurseries and forests, and establishment of detailed selection standards.

8 staff, 6 researchers/engineers and 2 office staff.

Calculation base: Based on the position of equipment and apparatus required for the above mentioned functions.

Furnishings : Side bench, work bench, desks, chairs, lockers, glazed cupboard, personal computer stand, and cabinet.

⑩ Library

Function : Accommodation of books, collection of technical materials, exhibition of books on education and research, and provision of a space for reading these books and materials.

Calculation base: $11,000 \text{ books} / 220 \text{ books/m}^2 = 50\text{m}^2$

Reading: 9 readers +
space $0.67/\text{m}^2 = 13.5\text{m}^2$

A total of 63.5m^2

Furnishings : Work bench, counter, cabinets accommodating bibliographies and for retrieval, book shelves, racks for perusal of magazines, and reading desks.

11 Meeting room

Function : For use by the Center staff and Japanese specialists for discussions or presentation of reports. Outsiders will also participate in the meetings. The Meeting Room will be designed so that it can be divided into multiple rooms by means of partitions when used by a small number of participants.

Calculation base: 3-person desks will be provided.

Center staff : 62

Japanese specialists : 6

Total : 68

As per the Collection of Building Design Materials, $1.7\text{m}^2/\text{person} \times 68 = 115\text{m}^2$.

Furnishings: Blackboard, projection screen, shelf, lecture desk, long tables (6-person type) and chairs.

12 Seminar Room

Function : A space in which researchers and engineers from Breeding Research Section hold discussions and present reports.

Calculation base: Long tables (each 3-person type) will be arranged in a square configuration. The Circle Room will be used by the following persons of the Breeding Research Section:

Researchers and engineers 17

Staff 6

Total 23

As per the Collection of Building Design Materials, $2.3\text{m}^2/\text{person} \times 23 = 53\text{m}^2$.

Furnishings : Long tables, chairs, glazed cupboards, and blackboards.

Other rooms will be designed to match the various established conditions, in terms of the required floor areas and the layout of furnishings and rooms. The following lists the planned floor areas of the Main Building and the outdoor facilities.

List of planned floor areas of the Center and its support facilities

Affiliation	Room	Floor area (m ²)		Remarks
		1F	2F	
Head	Head's room	40.96		
	Secretary's room	24.0		
	Reception room	39.2		
Japanese specialists	Japanese specialists' room	51.2		5 Japanese specialists
	Reception room	22.4		
	Japanese project leaders' room	28.8		
Indonesian specialists	Project manager's room		28.8	
Seminar room	Circle room		51.2	Capacity: 24 persons
	Meeting room		67.2	Capacity: 66 persons
General Affairs Section	Office room	102.4		Capacity: 13 persons
Planning and Coordination Section	Office room	102.4		Capacity: 11 persons
Services Section	Office room	102.4		Capacity: 12 persons
	Seed and pollen laboratory	102.4		Per arrangement of equipment
	Freezer			
Breeding Research Section	Selective breeding research room		102.4	Per arrangement of equipment
	Propagation research room		102.4	Per arrangement of equipment
	Information control research room		102.4	
Tissue Culture Room	Tissue culture room		51.2	Per arrangement of equipment
	Sample preparation room			
	Chemical room		102.4	Per arrangement of equipment
	Darkroom		22.0	Per arrangement of equipment
	Morphogenetic substances laboratory		67.2	
	Library		102.4	
	Entrance hall	131.6		
	Corridors	332.7	337.86	
	Office supplies storage	25.6		
	Storage	17.5		
	Book stack room	25.6		
	Laboratory equipment storage		27.0	
	Specimen treatment room	32.6		
	Mens' cloakroom	7.92		
	Womens' cloakroom	7.92		

	Relaxation room (men)	25.6	
	Relaxation room (women)	25.6	
	Dining hall and hot water service room	32.0	
	Mens' toilet	50.2	41.2
	Womens' toilet		
	Showerroom (men)	28.8	
	Showerroom (women)	19.2	
	Subtotals	1380	1205.66
	Total	2585.66	

List of planned floor areas of outdoor support facilities

Affiliation	Room	Floor area (m ²)	Remarks
Support facilities	Woodworking building	280	
	Crossing building	155.5	
	Cone drying room	86.9	
	Workers' room	102.4	
	Oil storage	12.0	
	Pump house	27.5	
	Garage	105.0	
	Hothouse with misting system	330.0	
	Electric generator and power distribution room	104.0	
		Total	1423.3