FPRDI - ITTO PD 47/88 Rev. 3(I)

Utilization of Lesser Used Species as Alternative Raw Materials for Forest Based Industries - - Phase I

Project Completion Report

Prepared for the : International Tropical Timber Organization

By the : Forest Products Research & Development Institute

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PROJECT COMPLETION REPORT
PHASE I

A. Project Identification

(a) Title: Utilization of Lesser-Used Species as Alternative Raw Materials for Forest-Based Industries

(b) Serial Number: PD 47/88 Rev. 3(I) - Phase I

© Executing Agency: Forest Products Research and Development Institute (FPRDI)

(d) Host Government: Philippines

(e) Starting Date : 01 February 1993

(f) Actual Duration : 40 months

(g) Actual Project Costs: U.S.$ 516, 601.63

PART I. EXECUTIVE SUMMARY

1. Background Information About the Project

1.1 The Philippines forests, like most tropical countries, has a great variety of timber species numbering about 3,800 classified as either commercial or non-commercial species. Commercial species are those well-known locally and abroad and are industrially utilized in large quantities while the non-commercial are those not traditionally used or exploited in commercial quantities. Non-commercial are generally termed as lesser-used species (LUS) and lesser-known species (LKS). It has been suggested that LUS appears to be the most appropriate term for timbers outside the category of commercial species. For the purpose of the project, the term LUS was adopted.

Based on the ITTO-Funded Pre-Project on "Appropriate Supply of Wood Materials in Producing Countries with Dwindling Forest Resources: The Case of the Philippines" prepared by the Forestry Development Center (FDC) in 1990, of the 3,800 species, about 300 are large trees (dbh over 40 cm), 800 are medium-sized trees (dbh 30-40 cm), while the rest are small-sized tress and shrubs (dbh less than 30 cm). Over a hundred of these species are considered commercial and utilized but the bulk

of production and trade are provided mainly by about 12 species mostly belonging to the family Dipterocarpaceae. The ever-increasing demand for wood and wood-based products has put a tremendous pressure on the supply of traditionally commercial species resulting in the fast depletion of the country's dipterocarps.

Because of the growing demand for tropical hardwood species, there is a need to introduce and promote in the market the use of LUS to a wider extent. This will not only broaden the utilization of forest resources but will help expand the resource-base of the industry and reduce the pressure to the over-exploited commercial species. The limited utilization of LUS in the Philippines is attributed to the lack of market acceptance and the inadequate information on the basic and working properties and supply. In order to rationalize the effective utilization of LUS, the availability of supply must be ascertained; the basic and technological or working properties of the species should be known and established; and there must be an adequate market promotion strategy to gain market acceptance.

1.2 Specific Objectives

The specific objectives of the Project are:

(a) Select a number of LUS that are most promising from the point of view of their occurrence and silvicultural features and their technical properties. Collect, identify and authenticate LUS for herbarium and reference purposes and to prepare a field guide for their identification.

(b) Determine the basic and working or technological properties and characteristics of selected LUS in the Philippines.

(c) Assess the properties, identify species or group of species for specific-use.

(d) Develop and promote traditional and non-traditional/prototype and value-added products.

(e) Determine the effect of harvesting LUS on the collection of non-wood industrial products by upland forest dwellers.

1.3 Specific Outputs

After the completion of Phase I of the Project, the following must have been accomplished.

(a) Identification and authentication of some LUS for herbarium and reference purposes. Selection and identification of most promising LUS considering their occurrence, silvicultural features and technical properties.

(b) The basic, and working or technological properties of selected LUS have been tested, evaluated and established.

(c) Traditional and non-traditional value-added products have been developed and evaluated.

(d) Lumber and prototype products in the form of furniture, mouldings, other millworks and joinery, woodcraft and novelty items, floor parquet, wood wool cement boards, pallets, veneer and plywood, pulp and paper, laminated and bent items, and electric poles have been developed.

(e) The effect of harvesting LUS in selected Timber License Agreement (TLA) pilot areas on the collection of non-wood forest products by local upland forest dwellers have been evaluated and determined.

1.4. Strategy Adopted in Carrying out the Project

The strategy adopted in carrying out the project was primarily to ensure that the twenty-one (21) sub-projects or studies under the project are implemented smoothly based on the work plan or time table for project implementation. The main strategies and measures were followed.

1.4.1. Identification and designation of Project Staff and personnel namely: Project Leader, Asst. Project Leader, Consultants, twenty-one Sub-Project/Study Leaders, Project Accountant and Clerk Typists was done by Executing Agency in consultation with ITTO. The Terms of Reference (TOR) for the Project Staff as specified in the Project Document were properly emphasized. The part-time Local Consultants were identified, contacted and informed of their scope of work and responsibilities. The Research Assistants and Research Aides for the Project were recruited and oriented on their duties and responsibilities.

1.4.2 The Project Leader and the Asst. Project Leader made frequent dialogue with all the Staff and Personnel of the project and informed them of the objectives, the activities to be undertaken and expected output after the project completion. The Project Leader emphasized that as much as possible planned activities should be accomplished on specified time frame. A performance chart for the 21 R & D studies was prepared and that the quarterly performance of each study for the calendar year are reflected. Studies that are operating as planned and studies that are delayed in the their actual activities during the quarter and during the year can be identified. The Study Leaders are required to submit their quarterly, semi-annual and annual reports to the Project Leader.

1.4.3. The Project Leaders and the Local Consultants evaluated the implementation of each study every six months. They gave suggestions and recommendations to the Study Leaders on how to improve the conduct of the study and attain the set objectives. Similarly, the Project Steering Committee composed of the representatives from the ITTO, the FPRDI and the Dept. of Environment and Natural

Resources met every six months to monitor, review and evaluate the progress of project implementation. Discussed are issues and problems encountered in the implementation of the project. Remedial measures are generally forwarded.

1.4.4. The Project Leaders prepared and submitted to ITTO a semi-annual progress report, a Steering Committee report and a report on the statement of budget, expenditure and balances for information. The release of project budget by ITTO to FPRDI was usually dependent on the submission of the abovestated reports.

1.4.5. Procurement of supplies and materials for the project followed the standard operating procedure of the Philippine government and the ITTO Guidelines for Procurement and Payment of Services. Request for cash advance for travel by project personnel likewise followed government procedure. All disbursements vouchers, documents or papers related to the above mentioned transactions were signed by the Project Leader, Asst. Project Leader, the Project Accountant and the Cashier. Checks/cheques were signed by either the Project Leader or the Asst. Project Leader and the Cashier. Project funds were deposited by ITTO in a government bank at Los Banos, Laguna, Philippines which was recently privatized. All funds required for the implementation of the project were drawn from the project bank account. Regular updating of project funds is being done with the bank.

1.5 The Project Planned Duration and Planned Overall Costs.

1.5.1 The planned duration of the project (Phase I and Phase II) is for five years with Phase I for three years and Phase II for two years. The period covered by this report is for Phase I.

1.5.2 The planned overall costs of the project was US$702,612.00 with Phase I amounting to US$555,650.00 and Phase II US$146,962.00

The specific sector in the Philippines that the project relates is the wood-based industry sector. The rapid depletion of the country's timber resources and the increasing demand for wood has been a major concern of the wood-based industries sector. Cognizant of the need to conserve the remaining forests and maintain the operation and growth of the wood-based industries, this project was conceived to determine the possibility of utilizing LUS as alternative raw materials for the known commercial species for the production of various industrial wood products.

Based from the Forestry Development Center Report in 1990, the projected potential wood supply in the production forest for sawlogs, peeler logs, pulpwood, poles and construction timber is 2.98 million cubic meter (m3) in 1990; 3.85 million m3 in 1995 and 5.86 million m 3 by the year 2000. The projected demand on the other hand for the period is about 3.49 million m3 in 1990; 4.23 million m3 in 1995 and 4.94 million m^3 by the year 2000. There is a deficit of 0.51 million m3 in 1990 and 0.38 million m^3 in 1995.

The total log production in 1989 was 3.2 million m3 of which 0.11 million m3 was exported. The remaining 3.10 million m^3 was processed into various products such as lumber, plywood, veneer, paper, other wood-based panel products, woodcraft, etc. Total lumber production was 0.975 million m3 of which 45% (0.438 million m^3) was exported and 55% (0.537 million m^3) was utilized locally. Plywood production was 0.344 million m3 of which 0.116 million m^3 was exported and 0.227 million m3 was consumed locally. Veneer production was 0.061 million m^3 which were all exported. The total value of exported wood and wood-based products was US$198.37 million. If 20% of the LUS trees with 50 cm diameter and up are harvested, this would amount to 236,600 m^3. At the price level in the local market in the 1989, the total value would amount to about P1.30 billion (US$ 46.58 million). At 50% utilization, lumber produced would be 118,300 m3 valued at about P752.38 million (US$ 26.87 million) local market and US$ 36.78 million in the export market. The utilization of LUS will significantly increase revenue and foreign exchange earnings of the country in addition to the forest conservation activity of the government.

2. Project Achievements

2.1 Outputs Achieved

2.1.1. A field guide to the identification of important lesser-used species of Philippine trees was established.

2.1.2. The anatomical structure and related properties of some lesser-used species was evaluated and established.

2.1.3. The Physical and mechanical properties of some lesser-used species was evaluated and established.

2.1.4. The chemical properties of some lesser-used species was evaluated and established.

2.1.5. The natural durability of some lesser-used species was evaluated and established.

2.1.6. The sawmilling characteristics of some lesser-used species was evaluated and established.

2.1.7. The seasoning characteristics of some lesser-used species was evaluated and established.

2.1.8. The ability of some lesser-used species to absorb chemical preservatives was evaluated and established.

2.1.9. The machining properties of some lesser-used species was evaluated and established.

2.1.10. The gluing characteristics of some lesser-used species was evaluated.

2.1.11. The bending characteristics of some lesser-used species was established.

2.1.12. The finishing properties of some lesser-used species was evaluated and established.

2.1.13. The pulping and papermaking properties of some lesser-used species was evaluated and determined.

2.1.14. The rotary veneering and drying characteristics of some lesser-used species was evaluated and established.

2.1.15. The suitability of some lesser-used species for the manufacture of furniture was tested.

2.1.16.The suitability of some lesser-used species for the production of floor parquet and picker sticks was tested.

2.1.17.The development of woodwool cement boards from lesser-used species was tested.

2.1.18.The treatability of some lesser-used species for electric and communication poles was tested.

2.1.19.The possibility of utilizing some lesser-used species for pallets was tested.

2.1.20.The production of millworks and joinery from lesser-used species was tested.

2.1.21.The Socio-Economic effect of harvesting lesser-used species on the collection and utilization of industrial non-wood forest products by local forest-dwellers was evaluated and determined.

2.2. Specific Objectives Achieved:

The specific objectives of the twenty one R & D studies had been achieved and a number of technical breakthroughs were made after three years of research efforts.

2.2.1 A field guide to the identification of important lesser-used species (LUS) of Philippine trees was developed for the benefit of the wood industry, forestry and wood science professors and students and the general public. A total of 60 taxa comprising of 57 species, 1 subspecies, 1 variety and one form under 33 families and 52 genera were described on morphological field characters. The study showed that the 60 taxa could be distinguished and identified in the forest based on peculiar morphological attributes of the bole, bark and blaze which when coupled with the general features of the leaves could facilitate the recognition and identification of timber species in the field.

2.2.2 The anatomical and related properties of 18 LUS belonging to 17 genera and 16 families were determined and established. Determined were the fiber dimensions, pore counts per square millimeter. Section slides for microscopic observation were prepared. Standard sampling procedure for fiber measurements and microscopic observations were followed.

2.2.3 Relative density and mechanical properties at green condition of 18 LUS were determined. Following relative density and strength properties grouping set by FPRDI, 2 LUS were classified under high relative density and strength; 2 LUS under moderately high; 4 LUS under medium; 3 LUS under moderately low relative density and 7 under moderately low strength; and 4 LUS under low relative density and strength.

2.2.4. The chemical properties of 14 LUS were analyzed following TAPPI Standard Test Methods. Results of analyses showed the following:

Holocellulose	49.94% to 78.43%
Lignin	15.48% to 43.75%
Alcohol-Benzene extractives	0.63% to 3.07%
Hot-water extractives	1..53% to 16.15%
1% Sodium hydroxide solubility	13.71% to 20. 80%
Pentosan	11.05% to 17.89%
Silica	0 to 0.18%

Since the chemical properties of wood influence its pulping and papermaking properties, the data obtained from the study were compared with the properties of wood species traditionally used for pulp production.

2.2.5 The resistance of 20 LUS against termites and powder-post beetles based on laboratory tests was conducted. Results showed that 6 LUS are non-resistant to termites, on the other hand 4 LUS are non-resistant to powder-post beetles, 6 LUS are moderately resistant and 10 LUS are highly resistant to beetles.

2.2.6 Sawing tests were conducted on some 32 LUS using laboratory and commercial sawmills. Pertinent data on log/lumber volume, lumber recovery, production rate and related information were determined/gathered. Depending on log geometry, cutting pattern and target dimension, lumber production ranged from 0.38 to 0.81 m^3/hr.; lumber recovery was 54 to 76%; fuel consumption was 3.30 liters/hr; and processing cost was P186.50 to P373.10/m^3. Lumber thickness is 25 mm. Using stellite-tipped sawblade gave higher lumber recovery than using high speed steel blade.

2.2.7 The seasoning characteristics of 20 LUS was tested and evaluated. Both air and kiln drying methods were employed to dry the lumber from green condition down to equilibrium moisture content EMC of 15% and below, about (8% to 11%). Four kiln drying schedules were used and the most common defects that developed were checking and warping. Mild stresses developed during drying. Checking starts to develop when the moisture content of the wood reached the fiber saturation point. Similar drying defects occurred in air drying. Drying defects however could be easily minimized by using the appropriate drying schedule.

2.2.8 The preservative treatment of some 16 LUS was completed employing the pressure and non-pressure methods of treatment and using water-soluble chemical preservatives (copper-chrome-arsenic and timbor). It was observed that the species of wood vary in their ability to absorb chemical preservatives. Some species are easily penetrated with chemicals and some are difficult to penetrate. The variation in the ability of wood species to absorb chemical preservative solution is primarily dependent on their anatomical structure and on the presence of some extraneous materials.

2.2.9 Following ASTM Standards, the machining properties of 21 LUS were established. As in preservative treatment, the cutting or machining behavior of the species tested vary considerably. The levels of moisture content tested are 10 to 12% and 15 to 17%,. In both moisture content levels, the planing, boring, mortising, shaping and turning properties of the wood species vary. Most of the species have good to very good planing, boring and shaping properties. Some have fair to poor turning and mortising properties. Density of wood and the anatomical structure, influence the surface quality of wood when subjected to cutting operations.

2.2.10 Gluing characteristics of 7 LUS was tested and evaluated using urea-formaldehyde (UF) and polyvinyl acetate (PVAC) adhesives. Gluing properties were measured but derived values, i.e., shear ratio and shear strength ratio were mainly used as bases for evaluating gluability class and bond durability class respectively. For UF adhesive, the optimum condition was 30 minutes assembly time and 171 g/m^2 glue spread. At this gluing condition, the 7 species exhibited mean values of over 90% for both the shear ratio and shear strength ratio. These indicators suggest that with UF adhesive, the 7 species tested are easy to glue and yield durable bond quality. With PVAC, the optimum gluing condition and best results varied among species.

2.2.11 Finishing properties of 12 LUS was established. The moisture content of wood, relative density, texture, color and extractives were used in assessing the finishing properties of wood. Stains and sealers were applied following the straight and full systems of finishing. The third system used was paint. Generally, the wood species tested exhibited good adhesion properties as indicated by the few squares of film that stuck to the tape when lifted from the sample surface. The finishing quality of the species ranged from good to excellent.

2.2.12 Bending characteristics of 21 LUS was established. For making bentwood components, the species tested were classified as follows:

a) **Solid Bends**

1. Species with very good bending quality, the radii of curvature less than 140 mm

2. Species with good bending quality, the radii of curvature from 140 to 250 mm

3. Species with fair bending quality, the radii of curvature from 251 to 500 mm.

b) **Laminated Bends**

1. Species with very good bending quality, radii of curvature less than 120 mm
2. Species with good bending quality, radii of curvature from 120 to 150 mm
3. Species with fair bending quality, radii of curvature from 151 to 175 mm.

There are 13 species found with fair bending quality, 5 with good and 3 with very good bending quality.

2.2.13 The pulping and papermaking properties of 10 LUS were determined. The pulping processes used were kraft or sulfate process, soda process, and chemi-mechanical process. Pulping results showed that chemical pulp yields of most species tested were comparable to the yields obtained from traditionally used hardwoods which range from 40 to 45%. Two species however, are not suitable for pulp production due to their very low pulp yield.

2.2.14 Rotary veneer cutting, drying and plywood making of some 12 LUS were tested and evaluated. Based from the results obtained, the species are suitable raw materials for veneer and plywood manufacture. The optimum knife setting, veneer drying condition and gluing characteristics were developed per species using two veneer thicknesses. The green veneer recovery was also determined per species.

2.2.15 The possibility of utilizing some LUS f or the production of wooden furniture was conducted. Prototype dining chairs were fabricated from 4 species of lesser-used timber using the mortise and tenon joint and the dowel butt joint. Adhesive used was polyvinyl acetate glue. The strength of the joints assembly of the prototype chairs was determined by subjecting the chairs to repeated impact load. Considering the average maximum load obtained for one side of the joint assembly which ranges from 588 kg to 1020 kg, the species tested are suitable for furniture production.

2.2.16 The utilization of some LUS for the production of floor parquet panels and picker sticks was conducted. Processing and assembly of parquet panels from 5 species of lesser-used timber was done in the plant of a private cooperator. The workability, relative density, volumetric shrinkage, hardness, drying characteristics, color, grain direction and texture of the species were assessed. Similarly, the prototype parquet panels were installed in a showroom with a floor area for 46 sq. m. for actual service test. For picker sticks, prototype solid and laminated samples were installed in a commercial textile mill for actual service test. Laminated samples were still in service after 5 months.

2.2.17 Development of 550 and 650 kg/m3 density wood wool cement boards from 5 LUS was conducted and their modulus of rupture, modulus of elasticity, nail head pull through, thickness swelling and water absorption capacity were likewise tested. Results obtained from tests conducted indicated that the 5 lesser-used timber species are suitable for woodwool cement board manufacture.

2.2.18 The possibility of utilizing lesser-used timber species for electric power and communication poles was undertaken. Some 12 species were chemically treated with water-soluble wood preservative (copper-chrome-Arsenic) using the high pressure sap displacement method and the full-cell. Based on the chemical absorption/retention obtained in the 2 methods of treatment, most of the species treated obtained satisfactory retention. Considering the physical structure (diameter and straightness of stem) and strength properties, four species may be suitable as pole material.

2.2.19 The utilization of some lesser-used timber species for pallets was conducted. Five LUS were use in the fabrication of prototype samples. Pallets measuring 91.44 cm x 91.44 cm were of the two-way entry type, reversible with flush stringers. The durability of the samples was determined by the drop test method. Dropping the pallets for one cycle each at 91 cm and 122 cm height levels did not inflict damage on the pallets. Other prototype samples are undergoing actual service test in beverage plants

2.2.20 Production of millworks and joinery using 16 lesser-used species was conducted. Prototype internal mouldings, louvre doors, balusters, solid doors and frames were fabricated. Assessment of the wood surface quality of prototype products after machining operation showed that 8 species are suitable for mouldings; 11 for louvre doors; and 9 species for balusters. The cost of production for each kind of product were likewise determined.

2.2.21 The socio-economic effect of harvesting LUS on the collection and utilization of non-wood industrial products by rural communities was investigated. There were about 400 upland dwellers in 11 concession areas covering 8 provinces interviewed using structured survey questionnaires. Some of the forest dwellers are former employees of the concession companies and others are migrant settlers engaged in chainsaw lumbering; rattan and bamboo gathering; sawali (woven bamboo mat) making; collection of orchids, almaciga and apitong resins, abaca stalks, anahaw leaves, vines and pandan, and hunting of birds and wild animals. Others derived their income from charcoal making, upland farming, poultry and swine raising. The collection of LUS is still not widely practiced in the areas visited. However, this activity arouses apprehension among forest dwellers because of the decreasing volume of non-wood products available in the concession area and the increasing distance of the collection site from the settler's dwelling areas which results in excessive migration. Some of the effects of LUS collection are:

a) Thinning and salvage cutting enhance rapid growth of bamboo. This contributes to the natural production/regeneration of rattan, specially the "sika" species which requires more open area and sunlight.

b) Opening of forest in terms of logging and construction of logging roads is advantageous to the forest dwellers for easy collection of forest products.

c) In case of forest dwellers who are mostly hunters of wild game animals, logging including collection of LUS does not have any adverse effect on their livelihood.

2.3. Contribution to the Achievement of the Development Objective

After three years of research and development efforts, the possibility of processing and utilization of lesser-used species of Philippine timber to help augment the supply of industrial wood was initially established. The production of lumber for the construction and related wood industry was also demonstrated. Many of the project's outputs and achievements have produced direct and indirect benefits to the producers and consumers of wood and wood products and to the government's forest conservation program particularly on remaining old growth forest of the country.

The selection of a number of lesser-used species that are most promising from the point of view of their occurrence/supply and silvicultural features and their technical properties were accomplished. The collection, identification of LUS for herbarium and reference purposes and the preparation of a field guide for their identification in the field were completed. Determination of basic properties such as anatomical, physical and mechanical, chemical, and natural durability, were also accomplished. Tests and evaluation of the working properties such as sawmilling, treatability, drying, pulping, machining, gluing, bending, veneering and finishing was completed.

Development of prototype products in the form of furniture, moulding, cabinet doors/louvres, balusters, solid doors, veneer and plywood, floor parquet, picker sticks, pallets, pulp and paper and wood wool cement boards were completed. The promotion of these products to the target clientele is an on-going activity. During the Twentieth Session of the International Tropical Timber Council in Manila, most of the above mentioned products were exhibited and there was a number of inquiries and appreciaton received by Project Management particularly on the supply of LUS and on the technologies involved in the production of value-added products.

In brief, the situation after the completion of project is not similar to the situation during the pre-project. The pre-project activities focused primarily on the assessment of demand for industrial tropical timber raw materials in the Philippines and the silvicultural potential of selected species that meet the availability, quality, economic competitiveness and market requirement for industrial utilization and consumption. It also reviewed logging, transport and raw material processing requirements and other problems associated with industrial utilization of the remaining available materials in the forests. It finally recommended projects/activities to promote plantation development and industrial use of selected species. On the otherhand, after the project completion, the basic information inherent on the species to warrant industrial utilization was determined. The various processing technologies involved to convert lesser-used species as materials for construction and for the production of traditional and non-traditional wood products for the domestic and export market were generated. After the project completion, there are some additional lesser-used species not indicated in the regional listing of the pre-project document that were included in the actual project implementation. The possible end-uses of the species

so far studied were identified considering their strength group classification, anatomical properties, relative ease of drying, surface quality after machining, their ability to absorb chemical preservatives and wood finishes, their glueability, bending and finishing properties.

In addition, a field guide for the identification of lesser-used timber species was completed. The socio-economic effect of harvesting lesser-used species on the collection of non-wood forest products by upland/forest dwellers was initially established after the completion of Phase I of the project.

3. Target Beneficiaries Involvement

The project was implemented in cooperation and support of the Department of Environment and Natural Resources (DENR) and the Timber License Agreement (TLA) holders specifically, Aras-Asan Timber Company Inc., Verdant Agro-Forest Development Corporation, Industries Development Corporation, Pacific Timber Export Corporation, Southeastern Timber Corporation and Aurora Timber Industries Corporation. The DENR provided the permit to the Executing Agency, FPRDI to collect/harvest LUS from the concession areas the required experimental materials (LUS logs). They also provided assistance in the survey, collection, processing (sawmilling and veneering) and in some instances transporting of logs and lumber.

Other project activities that were undertaken in cooperation with the beneficiaries were fabrication of prototype products in the form of floor parquet panels, picker sticks for textile mills, fabrication and testing of chairs and pallets. There was a harmonious relationship/cooperation between FPRDI researchers/personnel and that of the beneficiaries. Although some of the firms stated in the project document were not able to directly participate in the Phase I implementation, their umbrella organizations such as the Philippine Wood Producers Association (PWPA), the Chamber of Furniture Industries of the Philippines (CFIP) and the Philippine Chamber of Handicraft Industries (PCHI) were formally informed of the Phase I output of the project. Considering that the primary beneficiaries of the project are the members of the abovementioned associations, the officers of these associations have committed their support and cooperation during the promotion activities (Phase II) of LUS to the wood industry sector. It is fully expected that the wood industry will utilized the technologies and other information derived form the project.

4. Lessons Learned

4.1 Development Lessons

4.1.1 Aspects of Project design which contributed in achieving the development objectives.

The design of the project is simple and rational. After the approval of the project proposal by the ITTC and the release of funds by ITTO Secretariat, Project Management (PM) headed by the Project Leader and the Assistant Project Leader convened a meeting with the Sub-Project Leaders or Study Leaders. In this meeting, the working plan of the whole project and sub-projects were thoroughly discussed, assessed and reexamined. The members of the Local Project Monitoring and Evaluation Committee were selected and formed to undertake a review and evaluation of the project activities every after six months. The activities of the Committee was coordinated with the Project Monitoring, Review and Evaluation being conducted by the ITTO Representative, the Philippine Government Representative and the Executing Agency Representative. The three local consultants to the project were also present during the meetings. After three years of implementation, it is evident that the project workplan was carried out smoothly and as per planned targets. Based on the outputs obtained, it is quite clear that the development objective of the project was attained. This has indicated that the project design is very appropriate and successful.

4.1.2 Changes in intersectoral links which affected the project's success

So far, during the implementation of the project there were no changes in intersectoral links that affected the project's success. There was a strong linkage and cooperation between FPRDI and ITTO and likewise between FPRDI and DENR including their regional offices together with TLA holders in which the experimental materials were collected. The ITTO was very supportive to the project not only on the release of funds but also on the aspect of project monitoring, review and evaluation. It is believed that this cooperation will be maintained and continue in the future.

4.1.3 Additional arrangement that could improve cooperation between the relevant parties interested in the project.

Aside from the usual linkage and cooperation between FPRDI, DENR, and ITTO, the Executing Agency (FPRDI) had worked-out additional arrangement and activities with TLA or Forest Concession owners with facilities for sawmilling of logs and veneer cutting to conduct the sawing and veneering of LUS in their plants instead at FPRDI. In so doing, the concession owners had the first hand knowledge and information on the sawing and veneering properties of LUS available in their area. Similarly, some members of the Chamber of Furniture Industries of the Philippines were informed that some LUS have good potential for the production of furniture and other woodcraft. Arrangements were also made with active furniture makers that can test/use some of LUS in the project for the development of prototype products.

4.1.4 Factors which will most likely affect project sustainability after completion.

One of the factors that may affect the sustainability of the project after its completion is the kind of regulation and support the government would initiate particularly on the collection of LUS in residual forests in the country. Another important factor is the cost of LUS logs and lumber in the market. If the prevailing cost would be too high, the wood-using industry would have a problem in procurement and would rather use imported lumber or logs of lower cost.

The third factor that may affect sustainability of the project after completion is the adoption of processing methods/techniques for LUS by the wood processors and users. Inadequate dissemination/promotion of information and technologies on the proper utilization of LUS would affect their utility in both domestic and export arena. It is on this context that the Phase II of the project will concentrate its efforts and activities in the promotion of LUS as an alternate to the commercial timber species for the wood based industry.

4.2 Operational Lessons

4.2.1. Project Organization and Management

The principal experience gained on the successful implementation of the project (Phase I) is the effective and proper guidance of the Project Steering Committee and the critical review and evaluation of the Local Project Review and Evaluation Committee of the various activities undertaken. The dedicated services and efforts given by the Project Leader and the Assistant Project Leader to the management and implementation of the project led to the attainment of the established goals and objectives. The full cooperation and support of the individual Study Leaders contributed very significantly to the success of the project.

4.2.1.1 Project Organization System

The project organizational system is in the following order:

Project Steering Committee
Local Project Review and Evaluation Committee
Project Leader and Assistant Project Leader
Project Staff/Study Leaders

The Project Office was at FPRDI in College, Los Banos, Laguna Philippines.

4.2.1.2 Project Management Regulations

Project management regulations and procedures were followed in the following:

Project activities implementation

Project financial management/budgeting
Project assets management/upkeeping
Project monitoring and evaluation

4.2.2 Project Documentation

The Project document is the project proposal. Its number is ITTO PD 47/88 Rev. 3(I). For better and effective implementation of the project, Project Management has formulated and adopted some rules and regulations specifically in the supervision of project personnel; in the management of project budget; project assets; planning and monitoring of project activities. The documentation system followed was that; all project documents, reports, communications, letters must be filed and retained in the Project Office. After classifying and pooling, the documents were numbered in chronological order for easy access when needed.

4.2.3 Monitoring and Evaluation

Project Steering Committee (PSC) conducted semi annual meetings to check project's work, review and examine project's progress and discuss important issues and make decisions on important matters. During the meeting, the Project Leader reported to the committee the various activities undertaken by the project for the period under review. The members of the PSC are, one representative from ITTO, one representative from the government of the Philippines, and the Director of FPRDI representing the Executing Agency. The Assistant Project Leader acted as the Secretary of the PSC. Corrolary to the monitoring and evaluation of project implementation, the Local Project Monitoring and Evaluation Committee (LPMEC) together with the Local Consultants likewise conducted a semi-annual review and evaluation of the project. The members of the PMEC are one representative from the academe, one from the wood industry sector and one from the executing agency. The Assistant Project Leader acted as the Secretary of the LPMEC. Aside from reviewing and evaluating the project, the LPMEC made recommendations to ensure the successful implementation of the project.

4.2.4 Quality of Project Planning

The project plan was formulated after careful review and analysis of the various activities to be undertaken. A performance chart which indicates the individual studies/activities and its planned targets for a specific calendar year was prepared. After every six months, the actual performance output of each study was compared with planned targets. By this chart, project management easily detected which of the studies in the project were on tract, short of target and ahead of the planned target.

Travel of Project personnel, procurement of necessary supplies and materials were properly planned and coordinated by Project Management. Project Monitoring and evaluation were properly planned and coordinated with ITTO Secretariat, with

members of the PSC and LPMEC. In the overall, project planning was good and of desirable quality.

4.2.5. Definition of the Roles and Responsibilities of the Institutions Involved in the Project Implementation.

4.2.5.1 The Role of ITTO

The ITTO, as provided in the Agreement, contributed an amount not exceeding US$763,992.60 for the purpose of implementing the project. It conducted semi-annual monitoring and evaluation of the project implementation. Saw to it that the project was completed and that the objectives and expected output were satisfactorily attained.

4.2.5.2 The Role of FPRDI

The FPRDI implemented the project under the supervision of the Project Steering Committee in accordance with ITTC Decision 2(x), Annex 2 paragraph 3. It made available inputs in cash and in kind amounting to US$1,500,000.00 for the purpose of implementing the project. The contribution included the provision of land, office facilities and appropriate accommodation for all project activities. It provided ITTO technical progress and completion reports and periodic statement of budget, expenditure and balances.

4.2.6 Actions Taken to avoid Variation between planned and Actual Implementation (Schedule, Cost, etc.).

During the implementation of the project, the releases of funds by the ITTO were on schedule. The collection of experimental materials from TLA areas was well planned and coordinated. The facilities necessary for the conduct of the different activities under the project were available, so that in the overall operation, it can be stated that there was a very minimal deviation of the actual to the planned target activities. The establishment of a performance chart for individual studies/activities during the period of implementation served as a vital instrument in the conduct of the project.

4.2.7 External Factors that Influenced the Project Implementation That Could Have Been Seen

In the overall, the project went on as planned and with minor hindrance encountered during the initial stage of the project implementation. This hindrance was on the delay in granting of official permit by the Department of Environment and Natural Resources to FPRDI to collect some LUS in TLA areas. This bottleneck was easily solved by proper representation, dialogue and clarification with concerned officials.

4.2.8. External Factors that Influenced the Project Implementation That Could Have Been Seen

The increase in prices of supplies and materials during the second year of project implementation and the unforeseen appreciation of the Philippine-Peso against the U.S. dollars affected the project. To cushion the impact of these developments, a strict prioritization on the procurement of supplies and materials and on the travel of project personnel was initiated.

5. Recommendations

5.1 On Field Guide for Identification: Study 01 - A tie up study with the Ecosystems Research and Development Services (SRDS), DENR and private wood industries is necessary. The field assistance of people from these agencies is indispensable.

5.2 On Physical and Mechanical Properties: Study 03 - There should be a closer understanding between Study Leaders and the Collection Team on wood collection and sampling procedure. Considering that most of the studies are interrelated, the reliability and conclusiveness of the test results are also dependent on the sampling procedures.

5.3 On Sawmilling Characteristics: Study No. 06 - Sampling and processing of LUS logs should also be done in other areas with substantial volume of LUS. More representative sawmills should be negotiated for cooperation to have a more conclusive information. The use of sawmills designed for small-diameter logs is encouraged. This would increase volume recovery of lumber.

5.4. On Seasoning Characteristics: Study No. 07 - Since this is an integrated research project composed of several studies, it is recommended that substantial volume of each LUS should be collected to fully satisfy the requirement of the individual studies. There should be a readily available green storage tank or sprayline with running water continuously recycled to maintain the specimen in green condition prior to seasoning.

5.5 On Machining Properties : Study No. 08 - The use of surface roughness tester in evaluating the wood surface quality is highly recommended.

5.6 Bending Characteristics: Study No. 11 - The study on bending properties should be conducted in close coordination with glue-laminating properties. Bending study should include species behavior during the fixing and setting of bends to determine the allowance for springback.

5.7 On Rotary Veneer Cutting: Study No. 14 - Pilot scale production using LUS should continue to determine their commercial value. In processing LUS, segregation by species should be done in order not to complicate the setting of lathe and dryer temperature.

5.8 On Furniture: Study No. 15 - Substantial volume of LUS samples should be collected. Use pneumatic/hydraulic press in the assembly of prototype furniture.

5.9 On Woodwool Cement Boards: Study No. 17 - Further investigation to determine the suitability of other LUS should be undertaken to help expand the raw material base for cement bonded boards.

5.10 On Electric Power Poles and on Pallets : Study Nos. 18 and 19 - The identification of more cooperators willing to cooperate and assist in the conduct of the study is recommended. The Study Leader should be given the opportunity to participate in the collection of experimental materials. More detailed information on the source of raw material should be made available.

5.11 On Millworks and Joinery: Study No. 20 - Needed machines and other equipment should always be in good and operational condition. Sufficient raw material (LUS) must be available. Trained or skilled manpower must be available to conduct the study. Efficient experimentation and data gathering must be properly observed.

5.12 On Socio-Economic Effects: Study No. 21 - Since the nature of the study dealt more on data collection through interviews with forest occupants, socio-economic and demographic characteristics, trading and marketing of non-timber forest products, a staff with strong background in sociology or forest products economics and marketing should be involved in the study. This will help improve the quality of similar studies in the future

PART II. MAIN TEXT

1. Project Content

The project document was prepared in consonance with the relevant provisions of the International Tropical Timber Organization Staff Regulations and Rules. Specifically, its aims is to achieve objectives (b) and (c) as embodied in Article I of the International Tropical Timber Agreement (ITTA), which states: (b) To promote the expansion and diversification of international trade in tropical timber and the improvement of structural conditions in the tropical timber market by taking into account on one hand, a long term increase in consumption and continuity of supplies, and on the other hand, prices which are remunerative to producers and equitable to consumers and the improvement of market access. (c) to promote and support research and development with a view to improving forest management and wood utilization.

In addition the project related to the following areas of the ITTO mentioned under Article 23, paragraph 5: (a) Wood utilization, including the processing and utilization of lesser-used species; and (b) Natural forest development.

The project met the criteria stated in the ITTO Article 23, paragraph 6, which states that the project should:

a) be related to the production and utilization of industrial tropical timber;

b) yield benefits to the tropical timber economy and be relevant to producing as well as consuming members;

c) be related to maintenance and expansion of the international tropical timber trade;

d) offer reasonable prospects for positive economic returns in relation to costs; and

e) make maximum use of existing research institution and to the greatest extent possible, avoid duplication of efforts.

The general objective of the project was to increase the supply of industrial wood by increased utilization of lesser-used and lesser-known species subject to the condition that the increased harvesting does not endanger sustainable forest management nor the production of non-wood benefits. Increased production of lumber was the first priority but also millworks and joinery, wood cement boards, furniture, woodcraft, pulp and paper, veneer and plywood, parquet, pallets, textile implements and other related wood products were considered.

The rationale and relevant background information of the project indicates that the Philippine forests, like most tropical countries, has a great variety of timber species numbering about 3,800 classified as either commercial or non-commercial species. Commercial species are those well known locally and abroad and are industrially utilized in large quantities while the non-commercial are those not traditionally used or exploited in commercial quantities. Non-commercial species are generally termed as: miscellaneous, weed species, secondary species, lesser-used species (LUS) and lesser-know species (LKS). It has been suggested that LKS/LUS is to be the most appropriate term for timbers outside the category of commercial species. For the purpose of this project the term LUS was adopted.

Based on the ITTO-Funded Pre-Project report on "Appropriate Supply of Wood Raw Materials in Producing Countries with Dwindling Forest Resources: The Case of the Philippines" prepared in 1990 by the Forestry Development Center (FDC), of the 3,800 species, about 300 are large trees (dbh over 40 cm), 800 species are medium-sized trees (dbh 30-40 cm), while the rest are small-size trees and shrubs (dbh less than 30 cm). Over a hundred of these species are considered commercial and utilized but the bulk of production and trade are provided mainly by about 12 species mostly belonging to the family Dipterocarpaceae including the internationally known "Philippine Mahogany". The ever-increasing demand for wood and wood-based products has put a tremendous pressure on the supply of traditionally commercial species resulting in the fast depletion of one of the most important group of timber species in the country - the dipterocarps.

Because of the growing demand for tropical hardwood species, there is a need to promote and introduce into the market the use of LUS to a wider extent. This will not only broaden the utilization of forest resources but will expand the resource-base of the industry and reduce pressure to the over-exploited commercial species.

The limited utilization of LUS is attributed to the lack of information on basic and working properties including supply. In order to rationalize the effective utilization of the so-called LUS, information on their properties and characteristics has to be generated and made available to the industry.

Based on the consolidated forest land use data provided by the National Mapping Resources Information Authority (NAMRIA) as cited in the FDC Report, there are still over a million hectares of old-growth dipterocarp forests. However, most of these areas are located above 50% in slope or are in critical watershed or forest reserves and over 500 meters in elevation. These areas are uneconomical to operate, hence not suited for timber disposal (Master Plan for Forestry Development, 1989). Only about 35,000 hectares are found suitable for logging on a sustained basis, while the rest of the old-growth forest (1.114 million ha) are recommended as protection forest.

There are approximately 2.8 million ha of productive residual dipterocarp forest; 0.10 million ha of pine forest and about 0.171 million ha of forest plantations as of 1990. The total production forest is about 3.1 million ha which has been projected to be maintained up to the year 2000, beyond which the area is expected to increase as a result of intensified plantation development (FDC, 1990).

Based on the RP-German Forest Resource Inventory of 1986-88 (as cited in FDC Report, 1990), the average total volume per ha of LUS in residual forest with diameter of 20 cm and up is 43.7 cu m/ha. On the average, there are 20.4, 11.2 and 6.0 cu m/ha LUS for 50 cm and up, 60 cm and up and 70 cm and up diameter classes, respectively. Most of the LUS in 60 cm and up dbh are considered harvestable in view of the availability of already matured trees in these diameter classes. Using the above figures, it has been estimated that the total volume of LUS with 70 cm and up dbh is 0.413 million cu m. For 60 cm and up, 0.771 million cu m and 1.183 million cu m if we consider 50 cm and up dbh.

The project had two phases (Phase I and Phase II). Phase I undertook R&D studies using LUS including guides to proper field identification. The second phase will undertook studies on the establishment of production and economic data using developed technologies for pilot scale and commercial operations. It will also transfer and promote relevant information, processes and products to the wood-using industries. This phase will be implemented after the completion of Phase I.

After the completion of the Phase I of the project, the following output have been accomplished:

1. Identification and authentication of important LUS in the Philippines for herbarium and reference purposes have been established. Selection of LUS that are most promising considering their occurrence, silvicultural features and technical properties have been made;

2.The basic and working or technological properties of selected LUS have been evaluated and established;

3.Traditional and non-traditional high value-added products that can be derived from LUS have been identified; and

4.Lumber and prototype products in the form of furniture, millworks and joinery, woodcraft, novelty items, floor parquet panels, wood cement board, pallets, veneer and plywood, pulp and paper and electric poles have been developed from LUS.

The required inputs for the implementation of the project were the research and support personnel, the financial resources provided by the ITTO and the executing agency, the laboratory facilities and equipment for the conduct of the various studies; and the experimental materials and LUS collected from TLA holders in some regions of the country.

The project workplan and activities were specified to include the collection, monitoring, evaluation and documentation, and testing and evaluation of basic and working properties, as well as end-use properties determination, process and product development using selected LUS.

2. Project Context

The rapid depletion of the country's timber resources from the natural old-growth forest and the increasing demand for wood has been a major concern of the Philippine government and the forest based industries. Cognizant of the need to conserve the remaining forest and the forest based industries contribution to the national economy, the government has adopted some policies to promote the development and utilization of LUS as alternative raw materials for the forest-based industries. Although some of the LUS are now being processed into lumber, the wood industry is currently faced with technical problems in the area of botanical and wood identification, determination and assessment of wood properties, suitable end-uses and its efficiency in wood processing.

In this context, the FPRDI planned and conceived to implement a research and development project on the utilization of LUS and to conduct a technical assistance program to disseminate and transfer the relevant information and technologies obtained from the project to the target clientele and other beneficiaries. The technical assistance program will focus in helping the clients solve technological problem encountered in their production system, which would include technical advice, actual testing of materials and products, conduct of training courses, and transfer of commerciable technologies. Ultimately this will eventually help augment

raw material requirements and contribute towards the conservation of the country's forest resources.

This national development plan is closely link and coordinated with relevant sector of the local economy such as the wood furniture manufacturers, moulding, wooden doors and other builders woodworks industry, wooden pallets markers, veneer and plywood sector, utility poles producers and the wood-wool cement boards producers.

3. Project Design and Organization

3.1 Adequacy of the Results of the 'Identification Phase'.

The main issue to be solved by the project is how to increase the supply of industrial wood by increase utilization of lesser-used species in the Philippines. The workplan and strategy for the implementation of the various activities involved in the project were strictly followed to come up with the specified output contributed to the adequacy of the results of the identification phase.

3.2 Sound Conceptual Foundation of the Project

The main concept of the project is to increase the supply of industrial wood materials by increased utilization of lesser-used species available in the forests. This concept would follow a sequence of activities which include: (a) selection of a number of LUS that are most promising form the point of view of occurrence, silvicultural features and technical properties; (b) collection, identification and authentication of LUS of herbarium and reference purposes; (c) determination of the basic and working properties; (d) assessment of properties and identification for specific end-use; (e) development and promotion of traditional and non-traditional high value-added products; and (f) determination of the effect of harvesting LUS on the collection of non-wood forest products by upland forest dwellers.

The proper and effective conduct of the abovestated activities and support and cooperation of other government and private institutions ultimately led to the successful attainment of the specific and development objectives of the project.

3.3 Adequacy of Time and Other Resources for Project Formulation

The project proposal was conceptualized and formulated by the Director and a Senior Staff of FPRDI in 1987 and submitted to the Department of Environment and Natural Resources (DENR) for inclusion in their project proposal on LUS for foreign assistance or funding. The DENR submitted the said project proposal together with their project proposal on LUS Industrial Tree Plantation Establishment to ITTO Secretariat for consideration by ITTC during its session held in Abidjan, Cote D'Ivoire on May 1988. The ITTC adviced the proponent to revise the project proposal separating the production component from the utilization aspect and resubmit it to ITTO Secretariat. The revised project proposal on the utilization

component was re-submitted to ITTO and considered by ITTC during its session held in Quito, Ecuador on May 1990. In this Council Session, the ITTC decided that further revision be made on the project proposal to improve its objectives and its consistency to ITTO guidelines on sustainable management of tropical forest. FPRDI again reformulated the project proposal based on the comments and recommendations of Expert Panel of ITTO and presented the project to the Permanent Committee on Forest Industry during the Eleventh Session of ITTC in Yokohama, Japan on November 1991. After a critical evaluation by the Committee the project was finally approved and funded by the ITTC. The project was officially executed/started on 01 February 1993. Therefore the time for project formulation and reformulation was sufficient and the project plan and schemes were practicable.

3.4 Understanding and Appropriateness of the Roles and Responsibilities of the Institutions Involved with the Project Implementation.

The project was executed by FPRDI and was responsible for the management, administration and technical aspects during the implementation of the project. With ITTO's approval, FPRDI designated the Project Leader and Assistant Project Leader to manage and supervise the implementation. It also recommended for ITTO approval the Local and Foreign Consultants to assist and guide the project personnel in the implementation process.

The ITTO on the other hand provided the financial aspect of the project. It released and transferred appropriate funds to the executing agency semi-annually for the operation of the project. IT approves the assignment of the Consultants to the project. ITTO designated a representative to the Project Steering Committee and to the Project Monitoring and Evaluation Group. It required the executing agency to submit a periodic report of the Statement of Budget, Expenditure and Balances of the project funds, a report of project Steering Committee meetings, a regular Bi-annual project performance report and a completion report. The roles and responsibilities of the institutions involved as reflected in the project document were strictly followed and recognized by all concerned.

As expected, the roles and responsibilities of the institutions involved in the project were quite appropriate and properly understood and recognized.

3.5 Beneficiary Involvement with the Project's Efforts and Actions

It is quite important to state that the involvement of the beneficiaries with regard to the project's efforts and actions particularly the TLA holders, the wood furniture and woodcraft associations, the Philippine Wood Producers Association, and some upland forest dwellers' were worthwhile and very supportive. These involvement and support significantly led to the successful implementation and completion of the project.

4. Project Implementation

4.1 The Most Critical Differences Between Planned and Actual Project Implementation.

The implementation plan of the project is persuasive, direct and rational. Detailed arrangement and cooperative undertaking were made on the stage by stage implementation of the individual activities embodied in the workplan. Project Management carefully managed and supervised the actual implementation of the project particularly in relation to the component activities, schedules, costs and output achievement. With this operation, it can be safely stated that the actual implementation did not vary significantly with the original planned targets.

4.2 Measures and Actions Which Could Have Avoid these Variations

As mentioned above, no evident variations emerged during the implementation of the project.

4.3 Appropriateness of the Assumptions Made and Correct Identification of the Risks Involved

The continuity and smooth implementation of the project workplan was more or less directly related to the timely release and transfer of funds. This situation particularly minimized or eliminated the risks that were encountered in the course of the actual implementation of the project.

4.4 Project Sustainability After Project Completion as a Result of Project Implementation Conditions

The whole duration of the project implementation is for five years composed of Phase I for the three years and Phase II for two years. At this stage, the Phase I is already completed and Phase II is on-going in implementation. The Phase II activities focus primarily on the promotion of technologies, products and information obtain form Phase I to the wood-using industry. It will also prepare and publish reference manual on the basic and working properties of LUS and identify specific end-uses. After the completion of the whole project (covering phase I and Phase II), the sustainability of the project is therefore strong and dynamic. The continued use of some LUS so far tested and evaluated in the project by the wood based industries and the adoption of the technologies derived will ultimately support project sustainability.

4..5 Appropriateness of Project Inputs (Quality and Quantity)

Considering the inputs provided by the institutions involved in the implementation of the project, it can be considered as very rational and appropriate in attaining set objectives and expected output. The ITTO promptly provides the required funds.

The FPRDI provided the technical and support staff for the project. It also provided the necessary equipment and laboratory facilities for the conduct of the various activities of the Project. Additional testing equipment and service vehicle were also procured from ITTO funds. The quality and quantity of the project inputs are very reasonable.

5. Project Results

5.1 Situation Existing at Project Completion as Compared to The Pre-Project Situation

As summarized in Section 2.3 of Part I of this report, the situation during the Pre-Project to some extent differed with the situation after the completion of the project. In the Pre-project situation, the assessment of demand for industrial tropical timber material in the Philippines and the silvicultural potential of selected LUS that meet the availability, quality, economic competitiveness and market requirement for industrial utilization and consumption were made available. A recommendation on possible projects/activities to promote plantation development and industrial use of selected species was presented. On the other hand, after the project completion the basic and working properties and characteristics of LUS that warrant industrial utilization were determined. Processing technologies for converting LUS as materials for construction and the production of traditional and non-traditional wood products were generated. Additional LUS not listed in the regional listing of the Pre-project document were included in the project. Possible end-uses of LUS studied were identified after project completion. In addition, a field guide for the identification of important LUS was prepared for publication. Finally, the socio-economic effect of harvesting LUS on the collection of non-wood forest products by upland forest dwellers was initially identified after the completion of the Phase I of the Project.

5.2 Extent to Which the Project's Specific Objectives was Achieved.

The specific objectives of the Project Phase I have been achieved. The selection of promising LUS from the point of view of their occurrence, silvicultural features and technical properties was conducted. Collection, identification and authentication of LUS for herbarium and reference purposes was completed. Preparation of a field guide for their identification was completed. Assessment of basic and working properties and characteristics was completed. Identification of species or group of species for specific end-uses was accomplished. Development and evaluation of traditional and non-traditional wood product in the form of furniture, doors, louvres, mouldings, frames, floor parquet, pallets, balusters, novelty items, woodwool cement boards, pulp and paper, veneer and plywood and electric transmission poles were completed. The influence of harvesting LUS on the collection of non-wood forest products by upland forest dwellers was initially identified.

In the overall, the established objectives of Phase I were satisfactorily achieved. The piloting and promotion of all information, technologies, processes and products obtained in the first phase is at present an on-going activity of Phase II of the Project.

5.3 Impact of the Project Results on the Sectoral Programs, on the Physical Environment, on the Social Environment, on the Target Beneficiaries

The results of the project have some impact on the sectoral programs of the government particularly on the wood industry sector. It would help augment the supply of wood materials for housing construction, furniture and other millworks, utility poles and pulp for papermaking. It would not only help generate employment opportunities in the wood based industries but it will also help conserve the remaining old growth forest in the country since harvesting of LUS will be concentrated in second growth or residual forest. On the social environment, an initial information was generated that the small percentage about 9.8% of LUS harvested has little and manageable impact on the socio-economic environment of forest inhabitants. The minimal effect runs parallel with the survival and regeneration of some non-wood forest products like erect palms, rattan, vines, orchids and some wild animals and birds where they are dependent on particular LUS to sustain their existence. In the future, if the harvesting or extraction of LUS will not be regulated by the government, it is expected that the effect maybe significant. On the target beneficiaries, it is anticipated that the processors, exporters and users of wood products would be relieved to some extent of their problem on availability and supply of raw materials.

5.4 Project Sustainability After Completion as a Result of Project Conceptualization, Assumptions made and Conditions Prevailing at Completion.

The implementation period of the whole project (Phase I and Phase II) is five years. Phase I of three years has been completed and the expected outputs were satisfactorily attained. Such results are indicative that the conceptualization and assumptions made would contribute to the project sustainability after completion. The assumptions put forward has been formulated into working plans and are the basis for the on-going implementation of Phase II of the project.

6. Synthesis of the Analysis

6.1 Specific Objectives Achievements

Realized

6.2 Outputs

Realized

6.3 Schedule

On time

6.4 Actual Expenditures

As planned

PART III. CONCLUSIONS AND RECOMMENDATIONS

1. Development Lessons

In the implementation of a multi-disciplinary project funded by an international organization like ITTO, a clear view and understanding of project aim, objectives, expected outputs, project design and planning, and implementing strategies are very important. These aspects have been fully recognized and worked-out by the project. Detailed work plans of Phase I and its component studies and activities have been prepared in addition to full description of the project design and its implementation plans. As a result, the project plans worked smoothly and considered as a very encouraging development experience. Similarly, project budget and expenditure were properly and effectively planned and considered. It is very necessary to workout a strict financial management regulations considering that project scale is big that procurement and disbursements of funds is frequent and involved big amounts. This could reduce the risks greatly. Provisions for the use of contingency fund in the project budget should be properly identified to prevent some misconceptions during the actual implementation.

2. Operation Lessons

To implement international cooperative project, it is necessary to have a strong support from higher level authorities of cooperating institutions to come up with a smooth flow of information and all resources needed for the project implementation. The use of modern communication facilities greatly influenced the successful operation of the project. The usual delay in communicating and coordination with concerned agencies and organizations was practically minimized.

Strong support and dedicated guidance by Project Management to the technical staff, Study Leaders, Co-Researchers and support personnel during the actual implementation was a big contributing factor to the successful completion of the project. Strict management regulations particularly on all project personnel activities relative to the project workplan, were closely monitored and accounted for. Adoption of some regulations and rules of the Philippine government Civil Service in managing the project personnel contributed significantly to the smooth implementation and completion of the project.

The project organization system (The Project Steering Committee, the .Project Leader and Assistant Project Leader, the Study Leaders of the twenty one studies or sub-projects) particularly ensured that all activities have responsible persons to implement and accomplish them on time.

In this type of project, it is necessary to monitor and evaluate its progress in order to avoid any circumstances that may cause some hindrance or delays in the project work. On these aspects, the Project Steering Committee and the Local Project Monitoring and Evaluation Committee met twice a year to conduct monitoring and evaluation of the technical aspects and financial situation of the project. In all of these undertakings, the strict and skillful management of the Project Leader and the Assistant Project Leader led to the smooth implementation and completion of the Project (Phase I).

3. Recommendations for Future Projects (Phase II)

3.1 Identification

The identification of Project Phase II was accurate and revision is not needed considering that Phase I and Phase II were integrated in one Project Document PD 47/88 Rev. 3(I) and approved by ITTC during its Eleventh Session on December 04, 1991 in Yokohama, Japan.

3.2 Design

As presented in the above Project Document, the design of the project was adequate enough to include the required activities to be undertaken and the necessary manpower and financial resources to come up with the expected output of the project.

3.3 Implementation

The implementation strategies in Phase I can be adopted in Phase II since the latter is the actual piloting and promotion of the materials, information, technologies, and products developed in Phase I.

3.4 Organization

The organization and structure are similar except that the number of project personnel in Phase II is smaller than in Phase I, considering that there are only two studies or sub-projects being implemented in Phase II. There is at present no other alternative organization structure to adopt except to maintain and follow the organization set up established in the project document that led to the successful completion of Phase I.

3.5 **Management**

The management aspect of project was well executed during the duration of project implementation. For future projects, the management process may be strengthened by incorporating new, advance and applicable management tools to further improve the efficiency and effectiveness of the project implementation.

Responsible for the Report

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