

EX-POST EVALUATION
ITTO PROJECT PD47/88 Rev.3 (I)

REPORT

**“UTILIZATION OF LESSER-USED SPECIES AS
ALTERNATIVE RAW MATERIALS FOR FOREST-BASED
INDUSTRIES”**

Submitted to:

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I: EXECUTIVE SUMMARY

I-1 Background

The general objective of the project was to increase the supply of industrial wood through increased utilization of lesser-used and lesser-known species for the forest industry. This 5-year project promoted the utilization of lesser-used species (LUS) from the Philippines through research and dissemination of information on wood characteristics and processing, as well as by manufacturing and testing selected products. The project was designed to attain eight specific objectives:

1. To select a number of LUS species for the study that are most promising from the point of view of their occurrence and silvicultural features and their technical properties including whether they are plantable or not which means that some coordination with a planned plantation project is essential.
2. To collect, identify and authenticate lesser-used species for herbarium and reference purposes and to prepare a field guide for their identification.
3. To determine the basic and working or technological properties and characteristics of selected lesser-used species in the Philippines.
4. To assess the properties and identify species or groups of species for specific end-uses.
5. To develop and promote traditional and non-traditional high value-added products.
6. To conduct piloting and verification of technologies and information obtained from R & D activities.
7. To transfer developed and verified technologies and information to the wood industry.
8. To prepare a manual on the properties and uses of LUS in the Philippines.

These objectives were achieved by implementing the activities as planned in the project document, leading to the production of the following outputs:

1. A Field Guide to the “Identification of Important Lesser-Used Species of Philippine Trees” and a “Manual on the Properties and Uses of Lesser-Used Species of Philippine Timbers”.

2. Information was obtained on LUS properties covering anatomical structure and related properties; the physical, mechanical and chemical properties; the natural durability of the species; the saw milling and seasoning characteristics; the ability of LUS to absorb chemical preservatives; the machining, gluing, bending and finishing properties; the pulping and papermaking properties; and the rotary veneering and drying characteristics.

3. A number of LUS were tested and their suitability for manufacturing selected products assessed (furniture; floor parquet; woodwool cement boards; pallets; and millworks and joinery products).

4. The socio-economic effect of harvesting LUS on the collection and utilization of industrial non-wood forest products by local forest-dwellers was evaluated and determined.

5. The piloting of selected FPRDI-developed and improved LUS utilization technologies was affected. The promotion and transfer of appropriate wood utilization technologies on LUS to the wood industry sector was also affected.

This evaluation is an ex-post evaluation of the completed project PD 47/88 REV.3 (I) "Utilization of Lesser Used Species As Alternative Raw Materials For Forest Based Industries in the Philippines" which was awarded to the Forest Products Research and Development Institute (FPRDI), Department of Science and Technology, Republic of the Philippines. The actual duration of the project was 60 months (5 years) with a starting date of 15 February 1993. The ITTO funding award for the project was in the amount of US \$763,993.50 (Government of Japan). An additional match contributed by the Government of the Philippines was in the amount of US \$1,500,000 (in cash and in kind) for a total project budget of US \$2,263,993.50.

I-2 Evaluation Purpose

The Forest Industry Committee, at its Twenty-fifth Session in November 1999 decided that an ex-post evaluation should be carried out to establish how well the project served its purposes and to draw up conclusions for future actions.

I-3 Scope of the Evaluation

The following terms of reference were used for the ex-post evaluation work:

- i. To assess the project contribution to the achievement of its general objective which is the possibility of processing and utilization of lesser-used species of Philippine timber to help augment the supply of industrial wood and determine whether this has been initially established. Further, to determine whether the production of lumber for the construction and related wood industry was also demonstrated. The project implementing agency reported that many of the project's outputs and achievements have produced direct and indirect benefits to the producers and consumers of wood and wood products. These benefits should be assessed.
- ii. To assess the relevance and appropriateness of the research and development activities taking into account the available LUS wood raw materials and the market situation in the Philippines.
- iii. To assess the achievement of the project's outputs and specific objectives.
- iv. To evaluate the impact and relevance of the project; particularly its impact on the market aspects of LUS for small scale community enterprises.
- v. Determine the effectiveness of the technology transfer to the forest sector and to assess the overall post-project situation.
- vi. To assess unexpected effects and impacts, either harmful or beneficial, and present the reasons for their occurrence.
- vii. Analyze and assess implementation efficiency, including the technical, financial and managerial aspects.
- viii. Recommend follow-up actions in order to enhance utilization of project developed technologies and other results.
- ix. Taking into account the results of the evaluation, make an overall assessment of the project's relative success or failure to summarize the key lessons learnt; and identify any issues or problems which should be taken into account in designing and implementing similar LUS projects in future.
- x. Prepare the evaluation report in accordance with the terms of references for the Project Evaluation Report, as contained in the ITTO Manual for Project Monitoring, Review and Evaluation.
- xi. Assess the project contribution to the ITTA objectives and ITTO Action Plan.

Consistent with the ITTO Manual for Project Monitoring, Review, and Evaluation, Ex-Post Evaluation Checklist (ref. # 12; pg. 29), the ex-post evaluation was conducted in such a way as to allow answering these questions.

I-4 Conclusions of the Evaluation

General Objective

- a) The project accomplished its stated objective to “promote the utilization of LUS from the Philippines through research and dissemination of information on wood characteristics and processing, as well as manufacturing and testing selected products.”

Relevance and Appropriateness of the R&D Activities

- b) It has been shown that all aspects of this research relate to the access and supply LUS in the forests.
- c) The project developed or applied various small log technologies that may be suitable for adoption by small scale forest-based enterprises to utilize LUS in high value products.
- d) The project developed specific prototype products from LUS including: furniture and furniture parts, parquet flooring, woodwool cement boards, electric poles, pallets, millworks and joinery (including louvre doors, balusters, solid doors and door frames, and internal mouldings), and rotary veneer and plywood.
- e) The project conducted extensive technology transfer and promotional activities to disseminate technology and information (technical, product, and market) to relevant publics.
- f) The socio-economic impact of harvesting LUS on the collection and utilization of non-wood forest products was difficult to assess since the collection of LUS is not widely practiced in the areas visited by the FPRDI study team. Moreover, 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, and other non-wood forest product collection. However, most new activities and/or policies are typically met with apprehension by forest dwellers since the volume of non-wood products is decreasing in the concession areas.

Achievement of Project Outputs and Specific Objectives

- g) A Field Guide to the “Identification of Important Lesser-Used Species of Philippine Trees” and a “Manual on the Properties and Uses of Lesser-Used Species of Philippine Timbers” (Ref. #3 and #4).
- h) Information was obtained on LUS properties covering anatomical structure and related properties; the physical, mechanical and chemical properties; the natural durability of the species; the saw milling and seasoning characteristics; the ability of LUS to absorb chemical preservatives; the machining, gluing, bending and finishing properties; the pulping and papermaking properties; and the rotary veneering and drying characteristics.
- i) A number of LUS were tested and their suitability for manufacturing selected products assessed (furniture; floor parquet; woodwool cement boards; electric poles; pallets; and millworks and joinery products). Ulaian, nato, malak-malakm duguan, magabuyo, balakat, bitanghol, sagimsim, and mlugai-liitan - to make furniture, floor parquet, louvre doors, moulding and other builders’ woodworks - show the most promise for becoming economically viable in the Philippine forest industry.
- j) The socio-economic effect of harvesting LUS on the collection and utilization of industrial non-wood forest products by local forest-dwellers was studied.
- k) The piloting of selected technologies related to the improved utilization of LUS by the Philippine wood-based industries was conducted.
- l) The promotion and transfer of appropriate wood utilization technologies for LUS to the wood industry sector was also initiated.

Market Aspects of LUS for Small Scale Community Enterprises

- m) The long-term impact on local forest dwellers and regionalized small scale community enterprises is anticipated to be significant.
- n) The impact and relevance of the project will be affected by government policies in the Philippines that promote or hinder access to the natural forests (the supply of LUS).

- o) Challenges associated with harvesting and transporting LUS in/from second-growth forests by large-scale timber operations remain. Thousands of LUS are classified as small to medium-sized trees. They rarely or never reach 60 cm DBH (diameter-at-breast-height), regardless of their age. Inside TLA's (Timber Licensing Agreements), the harvesting of trees less than 60 cm DBH is prohibited (except along right-of-way, log landings, skid trails, and in tree plantations). However, this policy is currently under review by the DENR. DENR Executive Order (EO) No. 263 of July, 1995 adopted the CBFMP (Community-Based Forest Management Program) as the national strategy to ensure the sustainable development for the nation's forest resources. The CBFMP operationalizes the Master Plan for Forestry Development (MPFD) to provide participating communities with resource use rights for protection, rehabilitation, development, conservation, and management of the forest resources provided they employ environmentally-friendly, ecologically sustainable and labor-intensive harvesting methods.
- p) Small scale handicraft and furniture manufacturers are already using LUS. Small log technology transfer to these producers can provide direct benefits, provided they have access to adequate financial resources.
- q) The relatively small diameters of the available LUS in the Philippines will require significant capital investment for retooling. Many wood processors, particularly small scale community enterprises, lack the technical information on LUS properties and small log technologies. Promotional and technology transfer activities by the FPRDI are continuing – long after the project completion date.
- r) The relatively poor stem form of many LUS may entail unforeseen processing problems at commercial speeds that could offset the reduction in raw material costs – thus making these LUS raw materials more attractive for high value manufacture by small scale processors.
- s) Research on the silvicultural and economic characteristics of LUS for potential plantation production could have a favorable impact on a reliable

long-term supply of LUS. If so, this could greatly assist many of these small scale community enterprises.

- t) The harvesting of LUS should be combined with strategies for effective forest management in order to provide maximum long-term benefit to the Philippines.

Technology Transfer to the Forest Sector

- u) The FPRDI conducted a thorough and detailed and technology transfer program which continues through the present. In addition, an excellent promotional campaign has been implemented to inform relevant publics about the study results and commercialization opportunities.
- v) Numerous publications, reports, proceedings, and brochures have been produced and disseminated through this project. Promotional and technical assistance services on processing and utilization of LUS are currently being offered through the FPRDI in a variety of technical areas (see APPENDIX E for a copy of the brochure describing the nature and coverage of technical assistance services).
- w) Several innovative technologies were piloted in this project. In particular, small mobile horizontal band sawmills and HPSD (High Pressure Sap Displacement) methods of treating freshly cut logs for electric power poles show promise for improving the utilization of LUS in the Philippines.

Unexpected Effects/Impacts

- x) The characterization of LUS, in terms of strength, machining, saw milling, treating and drying characteristics, can be based (in part) on the density of the species.
- y) Some LUS are already being used for veneer, plywood, furniture (and furniture components, and handicrafts).
- z) Collection of the identified LUS is difficult due to the abundance and dispersion of the resource, the tremendous species diversity in the natural forest, and poor knowledge of location, quantities and size distributions.

- aa) The development of plantations for identified LUS that meet silvicultural and economic criteria for plantation forestry shows promise, but requires additional study.
- bb) The response rate obtained from the Philippine forest products industry in the marketing study by Eastin (1997 – Ref. #5) was quite low (4.6% response rate with a total of 24 usable responses from a mailing of 537 questionnaires).

Implementation Efficiency

- cc) All phases of the project, including conceptualization, implementation (technical, managerial, and financial), and completion have been effectively conducted by the FPRDI staff and the marketing consultant.

Overall Considerations

- dd) Production of lumber, furniture, handicrafts, woodwork and some of the other products studied, necessitates a reliable and sustainable supply of raw materials. It is difficult to address demand (promote increased utilization of LUS) if the supply (resource base) is not assured.
- ee) The project represented a badly needed study to increase the productivity of tropical forests around the world by improving the utilization of LUS.
- ff) Two years following completion of the project, it is estimated that the level of LUS extraction from the Philippine residual forest is about 5% to 15%, thus, the impact of the project is relatively low. However, it is anticipated that the future level of LUS extraction will reach 50% or more of the residual forest, thus magnifying the long-term impact.
- gg) Three quarters of responding Philippine wood processors (18 of 24 respondents) are incorporating LUS into their raw material mix. These manufacturers feel that their domestic customers are much more willing to accept products manufactured from LUS as compared to their foreign buyers. The availability of a reliable long-term resource supply and the availability of technical processing information were the two most important factors promoting the acceptance of LUS by Philippine manufacturers.

- hh) US importers and wholesalers of LUS tropical species felt that a low initial price, a reliable long-term resource supply, and the availability of promotional materials were the three most important criteria in their acceptance of LUS tropical species.
- ii) The forest industry is inherently conservative when it comes to adopting and accepting substitutes for traditional species due to issues related to supply reliability, manufacturing performance, and long-term in-situ service performance.
- jj) It is the general consensus of international experts in forestry and forest products utilization that the key to tapping the potential utilization of the vast number of tropical LUS is to develop knowledge of their properties and the relation of these properties to relevant and specific end-use markets (Bello 2000).
- kk) The project's impact was evident during the site visits to the handicrafts industries in Paete and Pakil, Laguna; attendance at the Philippine International Furniture Show 2000, and in discussions with the PWWA, CFIP, and DENR. In all cases, interviewees either showed LUS being incorporated into their manufacturing operations or strongly supported the improved utilization of LUS research agenda.
- ll) Other tropical timber producing nations can benefit from this work by following the research and development framework developed by the FPRDI.

ITTA/ITTO Context

- mm) The project satisfied the following ITTO/ITTA Objectives:
 - i. effective framework for consultation;
 - ii. promote non-discriminatory timber trade practices;
 - iii. contribute to sustainable development;
 - iv. enhance tropical timber exports from sustainably managed sources;
 - v. improve the structural conditions of international markets for sustainably managed sources of tropical timber;

- vi. support research and development which will improve forest management and wood use;
- vii. support capacity enhancement of producing members to attain ITTO objectives;
- viii. improve market intelligence of tropical timber species;
- ix. encourage more and further processing of sustainably managed tropical timber in producer countries;
- x. encourage reforestation, forest management, and rehabilitation of degraded forest land, with due regard for the interests of local communities;
- xi. improve marketing and distribution of tropical timber exports from sustainably managed sources;
- xii. encourage national policies to address sustainable forest management of genetic resources and maintaining ecological balance in the context of international trade;
- xiii. promote transfer technology; and
- xiv. encourage information-sharing on the international timber market.

I-5 RECOMMENDATIONS

Based on the findings of the ex-post evaluation, the following recommendations are offered concerning ITTO Project PD 47/88 Rev.3 (I):

- a) The establishment of LUS plantations in suitable areas may be one means to deal effectively with environmental groups regarding the harvesting, utilization, and marketing of LUS.
- b) A clear policy by the DENR addressing the harvesting and transport of LUS from second-growth forests would help promote the efficient utilization of LUS and support the development of sustainable forest management policy at the national level. And, the 60 cm diameter limit on harvesting trees from residual forests should be revisited (relative to LUS).

- c) Future marketing research questionnaires to the forest industries should consider designs to minimize length (respondent effort) and to encourage higher response. The development of multiple versions of a questionnaire, with each version mailed to a mutually exclusive sample of firms, has shown good results in similar situations for reducing questionnaire length and maximizing information. Potential non-response bias considerations may also be warranted.
- d) Annual surveys of the Philippine timber industry would provide timely and valuable information for developing further strategies for the utilization and marketing of LUS and to provide early identification and assessment of potential problems associated with the utilization of, and markets for, LUS.
- e) Other market-based information should be considered to improve the overall competitiveness of the Philippine forest-based industry and allow manufacturers (particularly small scale rural enterprises) to move up the value chain with a greater variety of high value-added products. These may include, but not be limited to, studies and/or seminars to address: differentiated products for domestic/international market niches; use and effectiveness of trade shows; use of e-commerce; and environmental certification (of sustainable management).
- f) The FPRDI marketing and promotion group should consider assembling a "Marketing of LUS Advisory Board" made up of the following groups: industry (primary and secondary); FPRDI (market analysts); DENR; FMB (Forest Management Bureau); and DTI (Dept. of Trade & Industries).
- g) Further research is needed to address the forest production of select LUS (identified in this project as possessing the desired properties for the manufacture of high value-added products) as plantation species in the Philippines. Some may have superior qualities as compared to the popular plantation species such as Gmelina, Facata, and Mangium. However, additional research is needed on the silvicultural and economic criteria for plantation forestry characteristics of LUS in the Philippines.

- h) Additional research is needed to better assess the ramifications of increased LUS harvesting on forest dwellers and the impact of these harvests on non-wood forest product collection.
- i) Technology transfer activities should continue, particularly with small scale wood processing enterprises.
- j) Policies to assist small scale enterprises with the procurement of suitable technology for the processing of small logs should be addressed.
- k) Additional research may address improving the forest-based inventory in the Philippines to make a reliable compilation of LUS, and which species occur in sufficient quantity, size, and location to have the greatest potential for utilization.
- l) Further research on other LUS aside from the 22 studied in this project, would be useful. Since the FPRDI now has the infrastructure and experience to conduct these studies, scale economies can be gained through a continuation of this work at this location. Results may then be transferred to other tropical timber producing nations and regions.

II: MAIN TEXT

II-1. PROJECT CONTEXT

**Terms of Reference for the Ex Post Evaluation of
ITTO Project PD 47/88 Rev.3 (I)
“Utilization of Lesser-Used Species as Alternative Raw Materials
for Forest-Based Industries”**

II-1.1 Background and Objectives

The Philippines, like many other tropical timber producing nations, grow thousands of timber species, but only commercially use only about a hundred or so species. The key to increase the utilization of the LUS is to have a sound knowledge of their location, quantities, size form and distribution, mechanical and physical properties relative to specific end-use requirements, and knowledge of industrial and end-use markets (domestic and international) for these species and/or species groups.

This 5-year project promoted the utilization of lesser-used species (LUS) from the Philippines through research and dissemination of information on wood characteristics and processing, as well as by manufacturing and testing selected products. The project was designed to attain **eight specific objectives**:

1. To select a number of LUS species for the study that are most promising from the point of view of their occurrence and silvicultural features and their technical properties including whether they are plantable or not which means that some coordination with a planned plantation project is essential.
2. To collect, identify and authenticate lesser-used species for herbarium and reference purposes and to prepare a field guide for their identification.
3. To determine the basic and working or technological properties and characteristics of selected lesser-used species in the Philippines.
4. To assess the properties and identify species or groups of species for specific end-uses.
5. To develop and promote traditional and non-traditional high value-added products.

6. To conduct piloting and verification of technologies and information obtained from R & D activities.
7. To transfer developed and verified technologies and information to the wood industry.
8. To prepare a manual on the properties and uses of LUS in the Philippines.

II-1.2 Activities and Outputs

These objectives were achieved by implementing the activities as planned in the project document, leading to the production of the following outputs:

1. A Field Guide to the “Identification of Important Lesser-Used Species of Philippine Trees” and a “Manual on the Properties and Uses of Lesser-Used Species of Philippine Timbers”.
2. Information was obtained on LUS properties covering anatomical structure and related properties; the physical, mechanical and chemical properties; the natural durability of the species; the saw milling and seasoning characteristics; the ability of LUS to absorb chemical preservatives; the machining, gluing, bending and finishing properties; the pulping and papermaking properties; and the rotary veneering and drying characteristics.
3. A number of LUS were tested and their suitability for manufacturing selected products assessed (furniture; floor parquet; woodwool cement boards; pallets; and millworks and joinery products).
4. The socio-economic effect of harvesting LUS on the collection and utilization of industrial non-wood forest products by local forest-dwellers was evaluated and determined.
5. The piloting of selected FPRDI-developed and improved LUS utilization technologies was affected. The promotion and transfer of appropriate wood utilization technologies on LUS to the wood industry sector was also affected.

The Forest Industry Committee, at its Twenty-fifth Session in November 1999 decided that an ex-post evaluation should be carried out to establish how well the project served its purposes and to draw up conclusions for future actions.

II-1.3 Planned Project Duration and Costs

The completed project PD 47/88 REV.3 (I) "Utilization of Lesser Used Species As Alternative Raw Materials For Forest Based Industries in the Philippines" was awarded to the Forest Products Research and Development Institute (FPRDI), Department of Science and Technology, Republic of the Philippines. The actual duration of the project was 60 months (5 years) with a starting date of 15 February 1993. The ITTO funding award for the project was in the amount of US \$763,993.50 (Government of Japan). An additional match contributed by the Government of the Philippines was in the amount of US \$1,500,000 (in cash and in kind) for a total project budget of US \$2,263,993.50.

II-1.4 Strategies Adopted for the Project

The major objectives (see Section II-1.1) led to activities that were undertaken in the successful implementation of the project (see Section II-1.2) and resulted in the strategic development of the following 23 Studies:

- Study 01: Field guide to the ID of LUS
- Study 02: Anatomical and related properties
- Study 03: Physical and mechanical properties
- Study 04: Chemical properties
- Study 05: Natural durability
- Study 06: Sawmilling characteristics
- Study 07: Seasoning characteristics
- Study 08: Preservative treatment
- Study 09: Machining properties
- Study 10: Gluing properties
- Study 11: Finishing properties
- Study 12: Bending properties
- Study 13: Pulping and papermaking properties
- Study 14: Rotary veneer cutting, drying, and plywood production
- Study 15: Utilization of some LUS for furniture
- Study 16: Utilization of some LUS for floor parquet

- Study 17: Development of wood wool cement boards
- Study 18: Utilization of LUS for electric poles
- Study 19: Utilization of LUS for pallets
- Study 20: Production of millworks and joinery
- Study 21: Socio-economic effects of harvesting LUS
- Study 22: Piloting of technologies/products from LUS
- Study 23: Promotion of technologies/information on LUS

The 5-year project had two phases: The first phase (1993-1996) focused on research and development on the basic working properties/characteristics of some select LUS in the Philippines and the identification of their appropriate end-uses. The second phase (1996-1998) dealt with dissemination of information obtained in phase one to the general public and the wood-using industries in the Philippines.

Phase one consisted of the Studies 1-21 with 14 Studies generating basic information; 7 Studies providing product development information; and 1 Study addressing economic information.

II-1.5 ITTO/ITTA Context of the Project

At its Twenty-fourth Session in Gabon in 1998, the International Tropical Timber Council (ITTC) approved the ITTO Libreville Action Plan 1998-2001 (see ref. #13). The new Libreville Action Plan 1998-2001 outlines a strategy for putting the ITTO objectives into practice and provides a focus for both policy and project work of the ITTO.

As its mission, “the ITTO facilitates discussion, consultation and international co-operation on issues relating to the international trade and utilization of tropical timber and the sustainable management of its resources.” Accordingly, this project is consistent with the overall mission of the ITTO.

The International Tropical Timber Agreement (ITTA), 1994 (ITTA, 1994), effective 1 January 1997 and replaces the Action Plan (for the ITTO) of 1990. This new Action Plan provides guidance on the overall direction and priorities of the ITTO to 2001, at which time ITTO members will review the scope of ITTA, 1994, and consider its extension. The following ITTO/ITTA objectives were addressed by this Project (PD 47/88 Rev. 3 (I)):

1. To provide an effective framework for consultation and cooperation on all relevant aspects of tropical timber economy;
2. To promote non-discriminatory timber trade practices;
3. To contribute to sustainable development;
4. To enhance tropical timber exports from sustainably managed sources;
5. To improve the structural conditions of international markets for sustainably managed sources of tropical timber;
6. To support research and development which will improve forest management and wood use;
7. To support capacity enhancement of producing members to attain ITTO objectives;
8. To improve market intelligence of tropical timber species;
9. To encourage more and further processing of sustainably managed tropical timber in producer countries;
10. To encourage reforestation, forest management, and rehabilitation of degraded forest land, with due regard for the interests of local communities;
11. To improve marketing and distribution of tropical timber exports from sustainably managed sources;
12. To encourage national policies to address sustainable forest management of genetic resources and maintaining ecological balance in the context of international trade;
13. To promote transfer technology; and
14. To encourage information-sharing on the international timber market.

Through ITTO's financial contribution to the project, it satisfied the selection criteria of ITTO and ITTA. And, the project addresses the following priority areas of the ITTO Committee on Forest Industry (see ref. #13):

The Year 2000 Objective, which is the goal of having all tropical timber entering international trade come from sustainably managed sources by 2000, includes the following four key action items:

1. Forest security;
2. Production of the optimal mix of goods and services;
3. Improvement of the utilization of the resource for the greatest possible social benefit; and
4. Improvement of the social and political environment concerning forest management.

II-2 EVALUATION SCOPE AND FOCUS

II-2.1 Type of Evaluation

This report represents the findings of an ex-post evaluation conducted approximately 2 years following the project completion. The evaluation was conducted according to the recommendations of the ITTO Manual for Project Monitoring, Review, and Evaluation, Second Ed., 1999 (Ref. #12). The following relevant sections of the Manual were used to formulate the specific approach to the evaluation:

ANNEX E:	Logical Framework Matrix, pg. 20.
Section II, C:	Ex-Post Evaluation, pg. 24
ANNEX A::	Checklist for Clarification for Evaluation Mission, pg. 29.
ANNEX B:	Terms of Reference - Project Evaluation Report, pp. 30-33.

II-2.2 Terms of Reference

The following terms of reference were used for the ex-post evaluation work:

- i. To assess the project contribution to the achievement of its general objective which is the possibility of processing and utilization of lesser-used species of Philippine timber to help augment the supply of industrial wood and determine whether this has been initially established. Further, to determine whether the production of lumber for the construction and related wood industry was also demonstrated. The project implementing agency reported that many of the project's outputs and achievements have produced direct and indirect benefits to the producers and consumers of wood and wood products. These benefits should be assessed.
- ii. To assess the relevance and appropriateness of the research and development activities taking into account the available LUS wood raw materials and the market situation in the Philippines.
- iii. To assess the achievement of the project's outputs and specific objectives.
- iv. To evaluate the impact and relevance of the project; particularly its impact on the market aspects of LUS for small scale community enterprises.
- v. Determine the effectiveness of the technology transfer to the forest sector and to assess the overall post-project situation.
- vi. To assess unexpected effects and impacts, either harmful or beneficial, and present the reasons for their occurrence.
- vii. Analyze and assess implementation efficiency, including the technical, financial and managerial aspects.
- viii. Recommend follow-up actions in order to enhance utilization of project developed technologies and other results.
- ix. Taking into account the results of the evaluation, make an overall assessment of the project's relative success or failure to summarize the key lessons learnt; and identify any issues or problems which should be taken into account in designing and implementing similar LUS projects in future.
- x. Prepare the evaluation report in accordance with the terms of references for the Project Evaluation Report, as contained in the ITTO Manual for Project Monitoring, Review and Evaluation.
- xi. Assess the project contribution to the ITTA objectives and ITTO Action Plan.

Consistent with the ITTO Manual for Project Monitoring, Review, and Evaluation, Ex-Post Evaluation Checklist (Ref. #12; pg. 29), the ex-post evaluation was conducted in such a way as to allow answering these questions.

II-2.3 Duration of the Evaluation

The ex-post evaluation was conducted within a four month period, commencing February 1, 2000 and ending no later than May 31, 2000. The evaluation employed the following work schedule:

14 February – 21 February 2000	Organizing the on-site visit. Developing pre-visit questions based on background study of the project.
22 February – 4 March 2000	Meeting of the consultant and project personnel in FPRDI's headquarters for briefing and comprehensive discussions on project implementation and results, as well as agreeing and preparing the work plan in further detail. Visits and discussions with project cooperators, beneficiaries, and other relevant parties.
5 March – 31 March 2000	Review of project information and results and preparation of draft report.
31 March 2000	Submission of draft final report to both ITTO and FPRDI for comments and suggestions.
15 April 2000	Finalization of report.
24-30 May 2000	Presentation of the report at the Twenty-Sixth Session of the ITTO Committee on Forest Industry (Lima, Peru).

II-3 EVALUATION METHODOLOGY

II-3.1 Review of Project Documents

The following documents were provided by ITTO to be used as background materials prior to the ex-post evaluation of PD 47/88 Rev.3 (I) "Utilization of Lesser-Used Species as Alternative Raw Materials for Forest-Based Industries". The following documents were included:

- 1.) ITTO Manual for Project Monitoring, Review and Evaluation
- 2.) ITTA 1994

- 3.) ITTO Action Plan
- 4.) Project Document PD 47/88 Rev.3 (I)
- 5.) Project Agreement (Contract)
- 6.) Progress Reports for the Project (10)
- 7.) Minutes of the Project Steering Committee Meetings (7)
- 8.) Project Completion Report
- 9.) Financial Audit Statements
- 10) International Consultant's Report - The Development of a Strategic Framework for Marketing Philippine Lesser Used Tropical Timber Species
- 11.) Manual on the Properties and Uses of Lesser-Used Species as Alternative Raw Materials for Forest-Based Industries
- 12.) Field Guide to the Identification of Important Lesser-Used Species of Philippine Timbers
- 13.) Proceedings from the Project Seminar.

II-3.2 Preparations for a Review Visit to FPRDI

The on-site visit to the Philippines were agreed upon by the FPRDI, ITTO, and the consultant and were consistent with the terms of reference. The consultant arrived in Manila, the Philippines at 04:00 on Thursday, 24 February 2000 and departed at 21:45 on Friday, 3 March 2000. Prior to the visit, the consultant prepared a set of questions for the following 8 different groups of respondents:

- Project Administrators
- Study Leaders
 - Resource Issues
 - Property Characterization Issues
 - Processing Issues
 - Marketing Issues
- Government Officials (Policy Issues)
- Industry Representatives (Industry Issues)

These questions were attached in an email and faxed to the Project Leaders (PD 47/88 Rev. 3 (I)) to facilitate an effective review and minimize interference with other, ongoing activities at the FPRDI (see ANNEX B for a complete set of the questions).

II-3.3 Review Visit

The primary purpose of the review visit was to verify past and ongoing activities related to the project (PD 47/88 Rev. 3 (I)). In addition, the on-site visit was used to conduct the following interviews with a variety of participants and beneficiaries of the project and to observe and document the effectiveness of this project on the utilization of LUS in the forest based industries in the Philippines.

INTERVIEWEES:

- Universities - UPLB, College of Forestry and Natural Resources** – Dr. Elvira Fernandez, Head, Department of Forest Products and Paper Science, Dr. Ramon Razal, Director, FORESTS, Dr. Lucrecio L. Rebugio, the Dean of the College of Forestry and Natural Resources and **University of Washington** (phone interview) - Dr. Ivan Eastin, Mktg. Consultant, Univ. of Washington.
- FPRDI – Administrators** - Dr. Emmanuel Bello, Dr. Florentino O. Tesoro, Dr. Arnaldo, Mosteiro, plus many other study leaders and project staff.
- DENR** - Monina M Cunanan, Development Management Officer IV, Quezon City; Dir. Eriberto C. Argete, Director for Planning and Policy, Quezon City.
- Handicrafts** - Ligaya M. Adelfuin, General Mgr., and Noel, Mgr., Ligaya Arts & Crafts, Paete, Laguna; Mr. Rodel, owner, E&R Handicraft, Pakil, Laguna; and Efren C. and Dory B. Armada, Owners, The Armada Crafts, Los Banos, Laguna.
- PWPA** - Antonio G. Bernas, Chairman of the Board, Felix T. Tamesis, VP Timber, and Jose A. Lorenzo, VP Forestry, IFP & Environment, PWPA, Makati City.
- Furniture** - Frocy G. Pascual, Vice-Pres., Golden Cane Furniture Mfg. Corp., Clark Field, Pampanga; Emmanuel P. Padiernos, Pres. & CEO, PADI, Inc., and President of the Chamber of Furniture Industries of the Philippines (CFIP), Las Pinas City; and Felix H. Hagad & Catherine Sicangco-Hagad, Proprietors, Art Energy Architecture & Contemporary Crafts, Badolod City, Negros Occidental.

Other Industrial - Fernando A. Lu, Director for Operations, Pacific Timber Export Corp. (Pateco), and President of the PWPA, Metro Manila and Makati City, respectively.

The consultant's travel itinerary in the Philippines is provided in ANNEX C. ANNEX D provides the written responses to the pre-evaluation questions submitted to the FPRDI by the consultant. ANNEX F contains photographs taken by the consultant during the on-site visit to the Philippines.

In addition, the summary of the project elements, related indicators, means of verifications, and important assumptions are provided in Table 3.3-1 as a logical framework matrix.

Table 3.3.1. Logical Framework Matrix for PD 47/88 Rev. 3 (I) "Utilization of Lesser-Used Species as Alternative Raw Materials for Forest-Based Industries."

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Development Objective:	<p>Shortage of commonly used and marketed species as raw material for the forest-based industries in the Philippines</p> <p>Possibility of processing and utilization of LUS of Philippine timber</p>	<ul style="list-style-type: none"> • Report – (1,2,3,4,5,6,7,8,9,14)¹ • Interviews – <ol style="list-style-type: none"> 1. Dept. of Environment and Natural Resources (DENR); 2. Chamber of Furniture Industries of the Philippines (CFIP); 3. Philippine Wood Producers Assn. (PWPA); 4. Pacific Timber Export Corp. (Pateco); and 5. FPRDI. • Site Visits – <ol style="list-style-type: none"> 1. Philippine International Furniture Show 2000, World Trade Center, Metro Manila; 2. Cavite Woodworks Assn., Silang, Cavite; 3. Ligaya Arts & Crafts, Paete, Laguna; 4. Rodel, Pakil, Laguna; and 5. The Armada Crafts, Los Banos, Laguna. 	<p>Availability of long-term, reliable supply of LUS in the Philippines</p> <p>Access to LUS in the Philippines (favorable policies)</p> <p>Harvesting LUS will be viewed favorably by small scale enterprises</p> <p>Suitable market demand (at economically feasible prices) for products produced from LUS in the Philippines</p>
Specific Objectives:	Select promising LUS – coordinate with a planned plantation project	<ul style="list-style-type: none"> • Report – (1,2,3,5,6) • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. UPLB – Drs. Fernandez & the Dean 3. DENR • Site Visits – FPRDI, DENR 	Plantation projects will be implemented

¹ Refer to Annex A – References.

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Prepare a field guide for the identification of select LUS	<ul style="list-style-type: none"> • Report – (1,2,3,6,7) • Interviews – FPRDI • Site Visits – FPRDI 	Info. may be acquired on morphological field characteristics
	Determine basic technological & working properties of select LUS for specific end-uses	<ul style="list-style-type: none"> • Report – (1,2,4,6,7) • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. E&R Handicrafts 6. The Armada Crafts 7. Golden Cane Furniture Mfg. 8. PADI, Inc. 9. CFIP 10. Art Energy Architecture & Contemporary Crafts • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. FPRDI 3. PWPA 4. Cavite Woodworks, Assn. 5. Ligaya Arts & Crafts 6. E&R Handicrafts 7. The Armada Crafts 8. Philippine Intern'l Furniture Show 2000 	Identified LUS will be feasibly available to the forest industry in the Philippines
	Develop and promote high value-added products from LUS	<ul style="list-style-type: none"> • Report – (2,4,5,6,7,15) • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Dr. Ivan Eastin, Univ. of Washington 4. Cavite Woodworks, Assn. 5. Ligaya Arts & Crafts 6. E&R Handicrafts 7. The Armada Crafts 8. Golden Cane Furniture Mfg. 9. PADI, Inc. 10. CFIP 11. Art Energy Architecture & Contemporary Crafts • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. E&R Handicrafts 6. The Armada Crafts 7. Philippine Intern'l Furniture Show 2000 	Working & technological properties will be suitable for high value-added product applications

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Pilot and transfer LUS technologies to the forest industries	<ul style="list-style-type: none"> • Report – (2,4,6,15) • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Golden Cane Furniture Mfg. 7. PADI, Inc. 8. CFIP • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Philippine Intern'l Furniture Show 2000 	The industry will cooperate with FPRDI & view the study as relevant
	Prepare a manual on the properties & uses of select LUS in the Philippines	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI • Site Visits – FPRDI 	Suitable LUS were identified and the product applications are relevant
Outputs	Reports	<ul style="list-style-type: none"> • Report – (5,7,8,9,10,14) • Interviews – FPRDI, Dr. Ivan Eastin • Site Visits – FPRDI 	
	Publications	1,3,4,6,11,12,13,16,17 – REVIEW	
	Brochures	2,15 - REVIEW	
	Technical articles	1 - REVIEW	
	Technology transfer	<p>See answers to ITTO Ex-Post Evaluation by Felix Tamolang – APPENDIX D, pp. 57-58. Includes descriptions of 8 completed techn. transfer activities.</p> <ul style="list-style-type: none"> • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Golden Cane Furniture Mfg. 7. PADI, Inc. 8. CFIP • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Philippine Intern'l Furniture Show 2000 	

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Use of LUS by the forest-based industry in the Philippines	<ul style="list-style-type: none"> • Report – (5) – see also answers to ITTO Ex-Post Evaluation by Felix Tamolang, APPENDIX D; pp. 57-58. • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Golden Cane Furniture Mfg. 7. PADI, Inc. • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Philippine Intern'l Furniture Show 2000 	
	Government activities	<ul style="list-style-type: none"> • Report – (6 – DENR Policies & Programs ... article + OPEN FORUM – pp. 75-90) • Interviews – FPRDI, PWPA, DENR, CFIP • Site Visits – FPRDI, PWPA, DENR, CFIP – at the PIFS 2000 	
Activities	LUS for the mfr. of Veneer & Plywood	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI, PWPA • Site Visit – FPRDI, PWPA 	Spindleless lathe technology is available for rotary cutting veneer from cores and small diameter logs
	LUS for the mfr. of pallets	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI • Site Visit – FPRDI 	
	LUS for the mfr. of furniture	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI, Cavite Woodworks, Assn., Ligaya Arts & Crafts, Golden Cane Furniture Mfg., PADI, Inc. • Site Visits – FPRDI, Cavite Woodworks, Assn., Ligaya Arts & Crafts, Philippine Intern'l Furniture Show 2000 	Consumer acceptance of LUS in the domestic and international marketplace Long-term, reliable supply of LUS and species groups
	LUS for the mfr. of handicrafts	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI, Ligaya Arts & Crafts, The Armada Crafts, E&R Handicrafts • Site Visit – FPRDI, Ligaya Arts & Crafts, The Armada Crafts, E&R Handicrafts, PIFS 2000 	
	LUS for the mfr. of parquet flooring	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI • Site Visit – FPRDI 	Consumer acceptance of LUS in the marketplace
	LUS for the mfr. of power poles	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI 	Satisfactory penetration & retention of chemical preservatives can be attained
	LUS for the mfr. of wood wool cement	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI 	

	LUS for the mfr. of cabinet doors, solid doors, balusters and moulding	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI • Site Visit – FPRDI 	
	LUS for the mfr. of lumber for light construction	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI 	Bandmill technology is available to better utilize small diameter LUS
	Socio-economic effects of harvesting LUS	<ul style="list-style-type: none"> • Report – (2,4,6) • Interviews – FPRDI, DENR • Site Visit – FPRDI, DENR 	Forest dwellers will benefit from the harvesting of LUS
	Pilot, & transfer and promote appropriate technologies & products from LUS	<ul style="list-style-type: none"> • Report – (2,4,6,15) • Interviews – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Golden Cane Furniture Mfg. 7. PADI, Inc. 8. CFIP • Site Visits – <ol style="list-style-type: none"> 1. FPRDI 2. PWPA 3. Cavite Woodworks, Assn. 4. Ligaya Arts & Crafts 5. The Armada Crafts 6. Philippine Intern'l Furniture Show 2000 	
	Development of a "Field Guide to the ID of LUS" and "A Manual on Properties & Uses of LUS"	<ul style="list-style-type: none"> • Review the two publications • Interview FPRDI staff, and external beneficiaries of these two publications 	
	Continuing research activities	<ul style="list-style-type: none"> • Interviews – FPRDI, Dr. Elvira Fernandez and Dr. Lucrecio L. Rebugio the Dean of the College of Forestry and Natural Resources. 	
	Continuing promotion & tech transfer activities	<ul style="list-style-type: none"> • Report – (1,2,15) • Interviews – FPRDI - see also answers to ITTO Ex-Post Evaluation by Felix Tamolang, APPENDIX D; pp. 57-58. Jan – Dec. 2000 – "Technical Assistance to Agrarian Reform Communities in Agusan del Sur" • Observed FPRDI staff continuing promotion and techn. transfer activities in all site visits 	
	Government plans	<ul style="list-style-type: none"> • Report – (6 – DENR Policies & Programs ... article + OPEN FORUM – pp. 75-90) • Interviews – FPRDI, PWPA, DENR, CFIP • Site Visits – FPRDI, PWPA, DENR, CFIP – at the PIFS 2000 	Balance between practical industry concerns (60 cm diameter limit) versus environmental concerns of enforcement
	Plans for future research related to utilization of LUS in the Philippines	<ul style="list-style-type: none"> • FPRDI and UPLB College of Natural Resources and Forestry were promoting the forest production - plantation proposal of identified LUS as a logical Phase II component of this project 	Adequate funding will be obtained

II-4. FINDINGS AND LESSONS LEARNED

II-4.1 Project Contribution to the General Objective

The research project PD 47/88 Rev. 3(I), through its 23 study components, has addressed its main objective, i.e. the possibility of processing and utilization of LUS of Philippine timber to help augment the supply of industrial wood and determine whether this has been initially established. And further, to determine whether the production of lumber for the construction and wood industry was also demonstrated. A significant contribution of this research project has been the development of a research framework for other tropical timber producing nations to follow when addressing this important issue in future studies and collaborations with the FPRDI.

A variety of LUS show great promise for supplementing the supply of industrial wood in the Philippines. Various species were identified and subsequently examined for potential processing into various end-use applications. As shown in Table 3.3-1, the general objective and the eight specific objectives of the project (see Section II-1.1) were addressed in a logical, concise manner with specific outputs and activities resulting. The specific publications were produced for LUS identification, properties and uses of LUS, and a Proceedings on utilization of LUS. The Proceedings covered a wide range of project topics addressing all eight of the identified objectives.

The FPRDI has thoroughly and professionally conducted the project in an efficient manner that addresses all of the study objectives. This study provides a methodological benchmark for subsequent work related to the increased utilization of LUS in all tropical timber producing nations in the world. The FPRDI and its staff should be commended for an excellent job of basic research on the species identification and LUS properties to the selection of LUS for various product testing to the evaluation of the socio-economic impacts of harvesting LUS to the piloting of various key technologies with the forest-based industry in the Philippines.

II-4.2 Relevance and Appropriateness of the R&D Activities Given the Available LUS Resource and Market Conditions in the Philippines

The increased utilization of LUS has been hampered by poor identification tools, limited technical characterization, and lack of effective market promotion. Further complicating the situation is that LUS in the Philippines could comprise as much as 25% of the total volume of standing timber in the productive dipterocarp and pine forests in the Philippines (18). Nearly 3,000 species of LUS occur sporadically over a wide area and typically have smaller diameters (< 60 cm DBH) and relatively poor stem form as compared to the commercially harvested and marketed species. In the Philippines, the harvesting of trees with less than 60 cm DBH is prohibited inside TLA's (Timber Licensing Agreements).

However, the LUS resource is still a significant source of wood raw material in the Philippines (as well as other tropical timber producing nations) and technological advances in small log utilization may allow for more efficient processing of small logs into a wide range of forest products. Further, the long-term impact on local forest dwellers and regionalized small scale community enterprises will most likely be quite positive. Therefore, the relevance and appropriateness of the R&D activities conducted in this project are perceived to be very high.

II-4.3 Achievement of Project Outputs and Specific Objectives

The project outputs were organized around 23 studies by the FPRDI. The following provides a brief summary for each study topic:

Study 1: Field Guide to the identification of important LUS.

A total of 60 taxa comprising 57 species, 1 subspecies, 1 variety and 1 form under 33 families and 52 genera were described in terms of their morphological field characteristics. The 60 taxa can be distinguished and identified based on the bole, bark and blaze that when coupled with the general features of the leaves could facilitate the recognition and identification of timber species in the field.

Study 2: Anatomical and related properties of some LUS.

Gross morphological characters, fiber dimensions, and pore count per square millimeter were determined and established for 18 LUS belonging to 17 genera and 16 families. Fiber length varies from 1.082 mm to 2.198 mm. Most of the tested species were found suitable for papermaking (they have a Runkle Ratio of < 1).

Study 3: Physical & mechanical properties of LUS.

The relative density and mechanical properties (green condition) of 18 LUS were determined and summarized as follows: (1) 2 LUS were classified as "high" density/strength; (2) 2 LUS were "moderately high" density (medium strength); (3) 3 LUS were "moderately low" density and 7 LUS were "moderately low" strength; (4) 4 LUS were "low" density and strength.

Study 4: Chemical properties of some LUS.

Using TAPPI test methods, 14 LUS were analyzed and compared with the properties of traditional pulping species. Some of the species show promise.

Study 5: Natural Durability of Some LUS.

The natural resistance of 20 LUS against termites and powder-post beetles was conducted. Six LUS are non-resistant to termites (45%+ weight loss); 4 are non-resistant to powder-post beetles; 6 are "moderately" resistant (11-12% weight loss) and 10 are "highly" resistant (0% weight loss) to powder-post beetles.

Study 6: Sawmilling characteristics of some LUS.

Pertinent data were obtained on lumber volume and lumber recovery and production rates via sawing tests conducted on 32 LUS using the FPRDI portable horizontal bandmill and other commercial bandmills. Stellite-tipped sawblades resulted in higher lumber recovery rates versus ordinary high-speed steel blades. Larger log diameters have higher lumber yields. Sawing patterns, log preparation and type of sawmill also affects lumber yields for the LUS tested.

Study 7: Seasoning characteristics of some LUS.

Air and kiln drying methods were assessed for 20 LUS using 4 kiln schedules. Eight LUS were classified as "easy" to dry; 8 were "moderately difficult;" and 2 were classified as "difficult." Use of appropriate drying schedules helped minimize drying defects.

- Study 8: Preservative treatment of some LUS.**
Pressure (full-cell process) and non-pressure treatments were conducted on 18 LUS using water soluble chemical preservatives (copper chromated arsenate [CCA] and timbor). Pressure treatment results identified 13 LUS as “easily” penetrated; 3 LUS as “moderately difficult” to penetrate; and 2 LUS as “difficult” to penetrate.
- Study 9: Machining properties of some LUS.**
ASTM standards were followed for evaluating the machining properties of 21 LUS. Most of the tested species exhibited good to very good planing, boring and shaping properties; these species are suitable for furniture, cabinets, moulding, and other builders’ woodwork. Some have fair to poor turning and mortising properties.
- Study 10: Gluing properties of some LUS.**
UF and PVAC adhesives were tested on 7 LUS using shear and shear strength ratios as bases for evaluating gluability class and bond gluability class. For UF adhesive, at 30 minutes assembly time and 171 g per m² glue spread, 7 LUS exhibited mean values of > 90% for both shear ratio and shear strength ratio and are therefore classified as “easy to glue” and “yield durable bond quality.”
- Study 11: Finishing properties of some LUS.**
Coating materials included stains, sealers, and topcoats to evaluate 12 LUS in terms of wood moisture content, relative density, texture, and color of wood and extractives content. Generally, the 12 LUS tested exhibited good adhesion properties.
- Study 12: Bending properties of some LUS.**
FPRDI standards (bending classification and critical radii of curvature) for 21 LUS were tested and evaluated. For solid wood bending, 12 species had fair bending properties; 5 had good bending; and 3 had very good bending properties. For laminated wood bending, 5 species had fair bending; 6 had good bending; and 8 species had very good bending properties.
- Study 13: Pulping and paper properties of some LUS.**
Kraft (sulfate), soda, and chemi-mechanical process were evaluated on 10 LUS. Chemical pulp yields of most LUS were comparable to the yields obtained from traditionally used hardwoods (40-45%). However, 2 LUS species had very low pulp yields (30%) and were not suitable for pulp production.
- Study 14: Rotary veneer cutting, drying, and plywood production of some LUS.**
The average green veneer recovery of 12 LUS species ranged from 32% to 61%. Optimal knife settings, veneer drying conditions, and gluing

characteristics were developed for each species using 2 veneer thicknesses (1 mm and 2 mm).

- Study 15: Utilization of LUS for the manufacture of furniture.**
Prototype dining chairs were fabricated from 4 LUS using the mortise and tenon joint and the dowel butt joint and polyvinyl acetate glue. Repeated impact loads ranged from 588 kg to 1020 kg, suggesting the species tested are suitable for furniture production.
- Study 16: Utilization of LUS for the production of assembled parquet panels and picker sticks.**
Processing and assembly of parquet panels from 5 species of LUS were done in a cooperators' plant to measure the workability, relative density, volumetric shrinkage, hardness, drying characteristics, color, grain direction, and texture. Prototype parquet panels were installed in a showroom. Samples were still in service after 5 months.
- Study 17: Development of woodwool cement board from LUS.**
MOR, MOE, nail head pull through, thickness swelling, and water absorption were tested on 5 LUS of 550 and 650 kg/m³ density wood wool cement boards. All 5 LUS were determined to be suitable for wood wool cement board manufacture.
- Study 18: Utilization of some LUS for electric and communication poles.**
Chemical treatment with copper chromated arsenate (CCA) using the high pressure sap displacement and the full cell method of 12 LUS was done to determine chemical absorption/retention. Most species obtained "satisfactory" retention and 4 species may be suitable for pole material when considering the physical structure (diameter and straightness of stem) and strength properties.
- Study 19: Utilization of LUS for pallets.**
Prototype two-way entry type, reversible with flush stringer pallets measuring 91.44 cm x 91.44 cm were fabricated using 5 LUS. The drop test did not inflict damage on the pallets. Prototypes are currently in service in beverage plants.
- Study 20: Production of millworks and joinery using some LUS.**
Prototype internal mouldings, louvres, doors, balusters, solid doors, and frames were fabricated using 16 LUS at two moisture contents (8-10% and 14-15%). Wood surface quality of the prototypes showed that 8 species are suitable for mouldings; 11 for louver doors; and 9 for balusters.
- Study 21: Socio-economic aspect of harvesting LUS on the collection and utilization of non-wood forest products.**

Approximately 400 forest dwellers in 11 concession areas covering 8 provinces were interviewed using structured questionnaires. Respondents include former concession company employees, migrant settlers engaged in chainsaw lumbering, rattan and bamboo gatherers, and other gatherers, hunters, and handicraft makers. LUS collection arouses apprehension due to the decreasing volume of non-wood products and the increasing distance of collection sites from the settler's dwelling areas. LUS logging opens the forest floor to enhance bamboo and rattan regeneration.

Study 22: Piloting of selected FPRDI technologies on LUS.

Twenty-one R&D studies on LUS resulted in the identification of the following 7 technologies for commercial validation: (1) utility poles using high pressure sap displacement (HPSD) treatment; (2) parquet flooring; (3) millwork and joinery; (4) furniture; (5) grocery pallets; (6) wood wool cement board; and (7) rotary veneer and plywood. Parquet flooring and HPSD were selected for piloting. Results show that four LUS species used for parquet flooring can compete with the traditionally used Narra species. The HPSD treatment of LUS was found to have a ready domestic market and be financially viable.

Study 23: Promotion and transfer of appropriate technologies on the utilization of LUS.

The manual on the properties and uses of 39 LUS found in the Philippines was prepared and published. Promotional prototypes of balusters, floor parquet, furniture, and wares were exhibited at 3 separate science and technology trade fairs and conferences. Press releases plus 6 Manila radio stations and the GMA TV station were used to promote LUS as alternative raw materials. A brochure on the promotion and technical assistance services on processing and utilization of LUS was prepared, printed, and disseminated to the wood industry sector. Ten technology transfer clinics and/or consultative dialogues on LUS processing and utilization were conducted in 7 regional centers in the Philippines. A total of 257 participants from wood furniture, builders' woodworks, forest-based communities, and other wood products sectors attended these sessions. Seminars were conducted for 150 professional foresters and 20 wood industry professionals at the ANEST Towers at College, Los Banos, Laguna.

II-4.4 The Market Aspects of LUS for Small Scale Community Enterprises

One major beneficiary of the increased utilization of LUS appears to be the small rural handicrafts industry. Site visits to Paete and Pakil, where nearly 75% of the 25,000 residents make their living in the handicrafts industry, illustrate the wide range of applications for LUS in a variety of hand-made wooden crafts. In addition, several

Philippine furniture manufacturers featured LUS in their exhibits at the Philippine International Furniture Show 2000. Some furniture manufacturers suggested that research on plantation-grown species (including potential LUS identified in this project) may be the long-term key to resource sustainability. Gmelina arborea (and introduced species) was mentioned as a potential “millennium species” for the Philippine furniture industry.

II-4.5 The Effectiveness of Technology Transfer to the Forest Sector

Most of the large scale forest products firms in the Philippines have access to the study’s output through their trade associations, or attendance at the Seminar by the FPRDI and ITTO on the “Utilization of LUS ...” held April 30, 1998, or any number of technical assistance visits, consultations, clinics, workshops, exhibitions, reports, publications, and/or radio and television communications. However, small scale enterprises may be scattered throughout the Philippine archipelago and may not have been exposed to these promotional programs.

The major impediment to increased use of LUS by the small scale processors in the Philippines remains inadequate processing facilities. These enterprises, not yet aware of the output of this study, need the information, and the capital to implement the technology to better utilize LUS.

II-4.6 The Unexpected Effects/Impacts of the Study

- There were few unexpected results emanating from this study. However, it was found that the characterization of LUS, in terms of strength, machining, sawmilling, treating and drying characteristics, can be based (in part) on the density of the species. That is, density level species grouping shows promise for future studies.

- Also, some LUS are already being used for veneer, plywood, furniture (and furniture components, and handicrafts. Collection of the identified LUS is difficult due to the geographic dispersion of the resource and the tremendous species diversity in the natural forest. The development of plantations for identified LUS that meet silvicultural and economic criteria for plantation forestry shows promise, but requires additional study.
- The policies of the Philippine government with regard to access to the forest-based raw materials was most likely anticipated; however, the recent change in leadership of the DENR may have a significant and favorable impact on government policies that currently hinder increased LUS utilization.
- Regarding the marketing study, most responding managers of the Philippine forest products industry indicated that they would be willing to try LUS in their manufacturing operations. However, the response rate obtained from the Philippine forest products industry was quite low (4.6% response rate with a total of 24 usable responses from a mailing of 537 questionnaires). It was recommended that annual surveys of the Philippine timber industry be conducted to monitor and assess problems associated with the utilization of and markets for LUS.

II-4.7 The Implementation Efficiency of the Project

The project was well conceptualized and implemented by matching study topics with the expertise and qualifications of the study leaders and teams. The Managerial efficiency is evident in the management of human and financial resources, the consummate scheduling and execution of the work plans, and the completion of tasks in a timely manner.

PART III CONCLUSIONS AND RECOMMENDATIONS

III-1 CONCLUSIONS

Based on the findings of the ex-post evaluation, the following conclusions are drawn concerning ITTO Project PD 47/88 Rev.3 (I):

1.1 General Objective

- a) The project accomplished its stated objective to “promote the utilization of LUS from the Philippines through research and dissemination of information on wood characteristics and processing, as well as manufacturing and testing selected products.”

1.2 Relevance and Appropriateness of the R&D Activities

- b) It has been shown that all aspects of this research relate to the access and supply LUS of forest resources.
- c) The following tests were performed:
 - i. A total of 60 new taxa of LUS were described in this study.
 - ii. Gross morphological characteristics, fiber dimensions, and pore count per square millimeter were determined for 18 LUS.
 - iii. The relative density and mechanical properties of 18 LUS were determined and summarized.
 - iv. The chemical properties of 14 LUS were analyzed.
 - v. The natural resistance of 20 LUS against termites and powder-post beetles was studied.
 - vi. Sawmilling characteristics of 32 LUS were examined.
 - vii. Air and kiln drying methods were assessed for 20 LUS using 4 kiln schedules.
 - viii. Pressure and non-pressure preservative treatments were conducted on 18 LUS using CCA and timbor.
 - ix. ASTM standards were used to evaluate machining properties of 21 LUS.
 - x. UF and PVAC adhesives were tested on 7 LUS.

- xi. Finishing properties of 12 LUS were evaluated.
 - xii. Bending properties of 21 LUS were evaluated.
 - xiii. Pulping and paper properties were evaluated on 10 LUS.
 - xiv. Rotary veneer cutting, drying, and plywood production techniques were developed for 12 LUS.
- d) The project developed or applied various small log technologies that may be suitable for adoption by small scale forest-based enterprises to utilize LUS in high value products.
 - e) The project developed specific prototype products from LUS including: furniture and furniture parts, parquet flooring, woodwool cement boards, electric poles, pallets, millworks and joinery (including louvre doors, balusters, solid doors and door frames, and internal mouldings), and rotary veneer and plywood.
 - f) The project conducted extensive technology transfer and promotional activities to disseminate technology and information (technical, product, and market) to relevant publics.
 - g) The socio-economic impact of harvesting LUS on the collection and utilization of non-wood forest products was difficult to assess since the collection of LUS is not widely practiced in the areas visited by the FPRDI study team. Moreover, 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, and other non-wood forest product collection. However, most new activities and/or policies are typically met with apprehension by forest dwellers since the volume of non-wood products is decreasing in the concession areas.

1.3 Achievement of Project Outputs and Specific Objectives

- h) A Field Guide to the “Identification of Important Lesser-Used Species of Philippine Trees” and a “Manual on the Properties and Uses of Lesser-Used Species of Philippine Timbers”.

- i) Information was obtained on LUS properties covering anatomical structure and related properties; the physical, mechanical and chemical properties; the natural durability of the species; the saw milling and seasoning characteristics; the ability of LUS to absorb chemical preservatives; the machining, gluing, bending and finishing properties; the pulping and papermaking properties; and the rotary veneering and drying characteristics.
- j) A number of LUS were tested and their suitability for manufacturing selected products assessed (furniture; floor parquet; woodwool cement boards; electric poles; pallets; and millworks and joinery products). Ulaian, nato, malak-malakm duguan, magabuyo, balakat, bitanghol, sagimsim, and mluagai-liitan - to make furniture, floor parquet, louvre doors, moulding and other builders' woodworks - show the most promise for becoming economically viable in the Philippine forest industry.
- k) The socio-economic effect of harvesting LUS on the collection and utilization of industrial non-wood forest products by local forest-dwellers was studied.
- l) The piloting of selected technologies related to the improved utilization of LUS by the Philippine wood-based industries was conducted.
- m) The promotion and transfer of appropriate wood utilization technologies for LUS to the wood industry sector was also initiated.

1.4 Market Aspects of LUS for Small Scale Community Enterprises

- n) The long-term impact on local forest dwellers and regionalized small scale community enterprises is anticipated to be significant.
- o) The impact and relevance of the project will be affected by government policies in the Philippines that promote or hinder and access to the natural forests (supply of LUS).
- p) Challenges associated with harvesting and transporting LUS in/from second-growth forests by large-scale timber operations remain. Thousands of LUS are classified as small to medium-sized trees. They

rarely or never reach 60 cm DBH (diameter-at-breast-height), regardless of their age. Inside TLA's (Timber Licensing Agreements), the harvesting of trees less than 60 cm DBH is prohibited (except along right-of-way, log landings, skid trails, and in tree plantations). However, this policy is currently under review by the DENR. DENR Executive Order (EO) No. 263 of July, 1995 adopted the CBFMP (Community-Based Forest Management Program) as the national strategy to ensure the sustainable development for the nation's forest resources. The CBFMP operationalizes the Master Plan for Forestry Development (MPFD) to provide participating communities with resource use rights for protection, rehabilitation, development, conservation, and management of the forest resources provided they employ environmentally-friendly, ecologically sustainable and labor-intensive harvesting methods.

- q) Small scale handicraft and furniture manufacturers are already using LUS. Small log technology transfer to these producers can provide direct benefits, provided they have access to adequate financial resources.
- r) The relatively small diameters of the available LUS in the Philippines will require significant capital investment for retooling. Many wood processors, particularly small scale community enterprises, lack the technical information on LUS properties and small log technologies. Promotional and technology transfer activities by the FPRDI are continuing – long after the project completion date.
- s) The relatively poor stem form of many LUS may entail unforeseen processing problems at commercial speeds that could offset the reduction in raw material costs – thus making these LUS raw materials more attractive for high value manufacture by small scale processors.
- t) Research on the silvicultural and economic characteristics of LUS for potential plantation production could have a favorable impact on a reliable long-term supply of LUS. If so, this could greatly assist many of these small scale community enterprises.

- u) The harvesting of LUS should be combined with strategies for effective forest management in order to provide maximum long-term benefit to the Philippines.

1.5 Technology Transfer to the Forest Sector

- v) The FPRDI conducted a thorough and detailed and technology transfer program which continues through the present. In addition, an excellent promotional campaign has been implemented to inform relevant publics about the study results and commercialization opportunities.
- w) Numerous publications, reports, proceedings, and brochures have been produced and disseminated through this project. Promotional and technical assistance services on processing and utilization of LUS are currently being offered through the FPRDI in a variety of technical areas (see ANNEX E for a copy of the brochure describing the nature and coverage of technical assistance services).
- x) Several innovative technologies were piloted in this project. In particular, small mobile horizontal band sawmills and HPSD (High Pressure Sap Displacement) methods of treating freshly cut logs for electric power poles show promise for improving the utilization of LUS in the Philippines.

1.6 Unexpected Effects/Impacts

- y) The characterization of LUS, in terms of strength, machining, sawmilling, treating and drying characteristics, can be based (in part) on the density of the species.
- z) Some LUS are already being used for veneer, plywood, furniture (and furniture components, and handicrafts).
- aa) Collection of the identified LUS is difficult due to the abundance and dispersion of the resource, the tremendous species diversity in the natural forest, and poor knowledge of location, quantities and size distributions.

- bb) The development of plantations for identified LUS that meet silvicultural and economic criteria for plantation forestry shows promise, but requires additional study.
- cc) The response rate obtained from the Philippine forest products industry in the marketing study by Eastin (1997) was quite low (4.6% response rate with a total of 24 usable responses from a mailing of 537 questionnaires). This does not suggest an error by the researcher, but rather an outcome of exploratory research (based on the allocated time and budget) and an issue to be addressed in subsequent market research studies of the forest industry in the Philippines.

1.7 Implementation Efficiency

- dd) All phases of the project, including conceptualization, implementation (technical, managerial, and financial), and completion have been effectively conducted by the FPRDI staff and the marketing consultant.

1.8 Overall Considerations

- ee) Production of lumber, furniture, handicrafts, woodwork and some of the other products studied, necessitates a reliable and sustainable supply of raw materials. It is difficult to address demand (promote increased utilization of LUS) if the supply (resource base) is not assured.
- ff) The project represented a badly needed study to increase the productivity of tropical forests around the world by improving the utilization of LUS.
- gg) Two years following completion of the project, it is estimated that the level of LUS extraction from the Philippine residual forest is about 5% to 15%, thus, the impact of the project is relatively low. However, it is anticipated that the future level of LUS extraction will reach 50% or more of the residual forest, thus magnifying the long-term impact.
- hh) Three quarters of responding Philippine wood processors (18 of 24 respondents) are incorporating LUS into their raw material mix. These manufacturers feel that their domestic customers are much more willing

to accept products manufactured from LUS as compared to their foreign buyers. The availability of a reliable long-term resource supply and the availability of technical processing information were the two most important factors promoting the acceptance of LUS by Philippine manufacturers.

- ii) US importers and wholesalers of LUS tropical species felt that a low initial price, a reliable long-term resource supply, and the availability of promotional materials were the three most important criteria in their acceptance of LUS tropical species.
- jj) The forest industry is inherently conservative when it comes to adopting and accepting substitutes for traditional species due to issues related to supply reliability, manufacturing performance, and long-term in-situ service performance.
- kk) It is the general consensus of international experts in forestry and forest products utilization that the key to tapping the potential utilization of the vast number of tropical LUS is to develop knowledge of their properties and the relation of these properties to relevant and specific end-use markets (Bello 2000).
- mm) The project's impact was evident during the site visits to the handicrafts industries in Paete and Pakil, Laguna; attendance at the Philippine International Furniture Show 2000, and in discussions with the PWPA, CFIP, and DENR. In all cases, interviewees either showed LUS being incorporated into their manufacturing operations or strongly supported the improved utilization of LUS research agenda.
- nn) Other tropical timber producing nations can benefit from this work by following the framework developed by the FPRDI to conduct this research project.

1.9 ITTA/ITTO Context

- oo) The project satisfied the following ITTO/ITTA Objectives:
 - a. effective framework for consultation;

- b. promote non-discriminatory timber trade practices;
- c. contribute to sustainable development;
- d. enhance tropical timber exports from sustainably managed sources;
- e. improve the structural conditions of international markets for sustainably managed sources of tropical timber;
- f. support research and development which will improve forest management and wood use;
- g. support capacity enhancement of producing members to attain ITTO objectives;
- h. improve market intelligence of tropical timber species;
- i. encourage more and further processing of sustainably managed tropical timber in producer countries;
- j. encourage reforestation, forest management, and rehabilitation of degraded forest land, with due regard for the interests of local communities;
- k. improve marketing and distribution of tropical timber exports from sustainably managed sources;
- l. encourage national policies to address sustainable forest management of genetic resources and maintaining ecological balance in the context of international trade;
- m. promote transfer technology; and
- n. encourage information-sharing on the international timber market.

III-2 RECOMMENDATIONS

Based on the findings of the ex-post evaluation, the following recommendations are offered concerning ITTO Project PD 47/88 Rev.3 (I):

- pp) The establishment of LUS plantations in suitable areas may be one means to deal effectively with environmental groups regarding the harvesting, utilization, and marketing of LUS.

- qq) A clear policy by the DENR addressing the harvesting and transport of LUS from second-growth forests would help promote the efficient utilization of LUS and support the development of sustainable forest management policy at the national level. And, the 60 cm diameter limit on harvesting trees from residual forests should be revisited (relative to LUS).
- rr) Future marketing research questionnaires to the forest industries should consider designs to minimize length (respondent effort) and to encourage higher response. The development of multiple versions of a questionnaire, with each version mailed to a mutually exclusive sample of firms, has shown good results in similar situations for reducing questionnaire length and maximizing information. Potential non-response bias considerations may also be warranted.
- ss) Annual surveys of the Philippine timber industry would provide timely and valuable information for developing further strategies for the utilization and marketing of LUS and to provide early identification and assessment of potential problems associated with the utilization of, and markets for, LUS.
- tt) Other market-based information should be considered to improve the overall competitiveness of the Philippine forest-based industry and allow manufacturers (particularly small scale rural enterprises) to move up the value chain with a greater variety of high value-added products. These may include, but not be limited to, studies and/or seminars to address: differentiated products for domestic/international market niches; use and effectiveness of trade shows; use of e-commerce; and environmental certification (of sustainable management).
- uu) The FPRDI marketing and promotion group should consider assembling a "Marketing of LUS Advisory Board" made up of the following groups: industry (primary and secondary); FPRDI (market analysts); DENR; FMB (Forest Management Bureau); and DTI (Dept. of Trade & Industries).

- vv) Further research is needed to address the forest production of select LUS (identified in this project as possessing the desired properties for the manufacture of high value-added products) as plantation species in the Philippines. Some may have superior qualities as compared to the popular plantation species such as Gmelina, Facata, and Mangium. However, additional research is needed on the silvicultural and economic criteria for plantation forestry characteristics of LUS in the Philippines.
- ww) Additional research is needed to better assess the ramifications of increased LUS harvesting on forest dwellers and the impact of these harvests on non-wood forest product collection.
- xx) Technology transfer activities should continue, particularly with small scale wood processing enterprises.
- yy) Policies to assist small scale enterprises with the procurement of suitable technology for the processing of small logs should be addressed.
- zz) Additional research may address improving the forest-based inventory in the Philippines to make a reliable compilation of LUS, and which species occur in sufficient quantity, size, and location to have the greatest potential for utilization.
- aaa) Further research on other LUS aside from the 22 studied in this project, would be useful. Since the FPRDI now has the infrastructure and experience to conduct these studies, scale economies can be gained through a continuation of this work at this location. Results may then be transferred to other tropical timber producing nations and regions.

ANNEX A

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ANNEX B

Questions Submitted to the FPRDI Prior to the Visit of the Evaluator

Ex-Post Evaluation of ITTO Project PD 47/88 – “Utilization of LUS as Alternative Raw Materials for Forest-Based Industries”

**Dr. P.M. Smith, Evaluator
Spring, 2000**

TARGETED GROUPS

- (1) Questions For Project Administrators**
- (2) Resource Issues (Study Leaders)**
- (3) Property Characterization Issues (Study Leaders)**
- (4) Processing Issues (Study Leaders)**
- (5) Marketing Issues (Marketing Consultant)**
- (6) Policy Issues (Government Officials)**
- (7) Industry Issues (Mfgs. From the Forest-Based Industry)**

QUESTIONS FOR PROJECT ADMINISTRATORS

1. How does the project relate to the:
 - a. sustainability of the Philippine forest resource?
 - b. improved efficiency of wood utilization?
 - c. policies of the Philippine government?
2. What criteria were used to arrive at the selected approach? That is, the:
 - a. objectives of the study;
 - b. LUS species selected for inclusion;
 - c. species/species groups, products and technologies selected for pilot plant research; and
 - d. target populations for primary data collection in the marketing research component.
3. How was the environmental impact of the project considered?
4. What measures can be/are being taken to ensure local community participation?
5. Can the value of the developed products be quantified?
6. How were the utilization of new species and products enhanced?
7. What new innovative technologies (methods of processing) were introduced or enhanced?
8. What is the socio-economic impact of harvesting LUS on the collection and utilization of industrial and non-industrial non-wood forest products by local forest dwellers?
9. What were the lessons learned from the project?
10. How well did the project serve its intent?
11. Clarify the impact of the project today and in the future.
12. How much of the gained knowledge is transferable to other tropical timber producing countries?
13. Identify unexpected results.
14. Was the funding adequate to complete the planned work?

15. Identify difficulties encountered with the ITTO proposal & project reporting procedures and requirements.
16. Identify further research and development needs.
17. Do you plan to seek additional funding from ITTO to continue the research?
18. Identify the key obstacles that stand in the way of adaptation of the developed products and technologies.
19. Should the FPRDI marketing and promotion group assemble a marketing of LUS advisory board? If so, who should be included on the board?
20. What is the biggest impediment to the increased utilization of LUS in the Philippines?
21. What other issues related to the utilization of LUS should be studied by the FPRDI?

RESOURCE ISSUES

Objective #1 – Select a number of the most promising LUS species (in terms of occurrence and silvicultural features – and in the context of potential as plantation spp.).

Objective #2 – Collect, identify and authenticate LUS for herbarium and reference purposes and to prepare a field guide for their identification.

LIST OF QUESTIONS FOR STUDY LEADERS:

1. Explain the selection process for the 60 LUS.
2. If you could select 60 species for identification and 22 species for property testing today, how would your selections differ and why? What did you learn from the project?
3. From the *resource perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
4. From a *marketing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
5. From a *manufacturing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
6. How do administrative policies either enhance or impede improved utilization of LUS by the Philippine forest-based industries?
7. Can you recommend a proactive strategy for dealing effectively with environmental groups regarding the harvest, utilization, and marketing of LUS?
8. What is/are the socio-economic impact(s) of harvesting LUS on the collection & utilization of industrial non-wood forest products by local forest-dwellers?
9. What lessons did you learn from the collection, identification and authentication of LUS for herbarium use that would facilitate another project? Did any problems arise?
10. What lessons did you learn from developing the “Field Guide to the Identification of LUS of Philippine Timbers” development?
11. In your opinion, who is/are the major beneficiary(ies) of this research? Please explain.
12. In your opinion, which of the LUS tested show the most promise for becoming economically viable spp. or spp. groups for the Philippine forest industry?
13. What geographic location(s) in the Philippines shows the most promise for using LUS as an alternative raw material in the forest-based industry? Why?

14. What success stories do you have regarding the transfer of technology from this project to the forest-based industries in the Philippines?
15. Did the project illuminate new challenges that should be addressed in future studies? Please explain.
16. In your opinion, what are the key lessons learned from the project?

PROPERTY CHARACTERIZATION ISSUES –

Objective #3 - Determine basic & working properties of selected LUS in the Philippines.

Objective #4 – Assess the properties & identify spp./spp. groups for specific end-uses.

Objective #8 – Prepare a manual on the properties and uses of LUS in the Philippines.

LIST OF QUESTIONS FOR STUDY LEADERS:

1. In your opinion, which of the LUS tested show the most promise for becoming economically viable spp. and/or spp. groups for the Philippine forest industry? What specific high value added products show the most promise?
2. What geographic location in the Philippines shows the most promise for using LUS as an alternative raw material in the forest-based industry? Why?
3. What success stories do you have regarding the transfer of technology from this project to the forest-based industries in the Philippines?
4. Explain the selection process for the 22 LUS.
5. If you could select 22 LUS for property testing today, how would your selections differ and why? What did you learn from the project?
6. From the *resource perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
7. From a *marketing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
8. From a *manufacturing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
9. How do administrative policies either enhance or impede improved utilization of LUS by the Philippine forest-based industries?
10. Can you recommend a proactive strategy for dealing effectively with environmental groups regarding the harvest, utilization, and marketing of LUS?
11. What is/are the socio-economic impact(s) of harvesting LUS on the collection & utilization of industrial non-wood forest products by local forest-dwellers?
12. What lessons did you learn from characterizing the properties and end-uses of the 39 LUS illustrated in the “Manual on the Properties and Uses of LUS of Philippine Timbers?”

13. What lessons did you learn from developing the “Manual on the Properties and Uses of LUS of Philippine Timbers?” that would facilitate another project? Did any problems arise?
14. In your opinion, who is/are the major beneficiary(ies) of this research? Please explain.
15. Did the project illuminate new challenges that should be examined when designing future studies? Please explain.
16. In your opinion, what are the key lessons learned from the project?

PROCESSING ISSUES –

Objective #5 – Develop & promote traditional and non-traditional high value-added products from LUS.

Objective #6 – Conduct piloting and verification of technologies and information from R&D activities.

Objective #7 – Transfer the technologies to the wood industry.

LIST OF QUESTIONS FOR STUDY LEADERS:

1. In your opinion, which of the LUS tested show the most promise for becoming economically viable spp. and/or spp. groups for the Philippine forest industry? What specific high value added products show the most promise?
2. What geographic location in the Philippines shows the most promise for using LUS as an alternative raw material in the forest-based industry? Why?
3. What success stories do you have regarding the transfer of technology from this project to the forest-based industries in the Philippines?
4. Explain the outcome of *Study 14 – rotary veneer cutting, drying, and plywood production* (in the context of this project). What LUS spp. were tested and what company(s) – if any - participated?
5. Explain the outcome of *Study 15 – utilization of some LUS for furniture* (in the context of this project). Which LUS spp. were tested? What company(s) participated?
6. Explain the outcome of *Study 16 – utilization of LUS for floor parquet* (in the context of this project). Which LUS spp. were tested? What company(s) participated?
7. Explain the outcome of *Study 17 – development of wood wool cement boards* (in the context of this project). Which LUS spp. were tested? What company(s) participated?
8. Explain the outcome of *Study 18 – utilization of LUS for electric poles* (in the context of this project). Which LUS spp. were tested? What company(s) participated?
9. Explain the outcome of *Study 19 – utilization of LUS for pallets* (in the context of this project). Which LUS spp. were tested? What company(s) participated?
10. Explain the outcome of *Study 20 – production of millworks and joinery* (in the context of this project). Which LUS spp. were tested? What company(s) participated?

11. What lessons were learned in the piloting of LUS for the major end-use applications listed above in *Studies 14-20*?
12. Are promotional fact sheets available for select LUS?
13. If you could select the major LUS and products for pilot testing today, how would your selections differ and why? What did you learn from the project?
14. From the *resource perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
15. From a *marketing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
16. From a *manufacturing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
17. How do administrative policies either enhance or impede improved utilization of LUS by the Philippine forest-based industries?
18. Can you recommend a proactive strategy for dealing effectively with environmental groups regarding the harvest, utilization, and marketing of LUS?
19. In your opinion, who is/are the major beneficiary(ies) of this research? Please explain.
20. Did the project illuminate new challenges that should be examined when designing future studies? Please explain.
21. In your opinion, what are the key lessons learned from the project?

MARKETING ISSUES –

LIST OF QUESTIONS FOR THE MARKETING CONSULTANT:

1. Explain the procedures for designing the marketing research study. What criteria were used to arrive at the selected approach?
2. Explain the domestic (Philippine) and the international market potential for products produced from LUS.
3. How was potential non-response bias in the Philippine Wood Processors survey addressed?
4. What procedures were used to maximize response rates from the Philippine Wood Processors?
5. What would you do differently in the future to acquire primary data from Philippine Wood Processors?
6. What mechanism(s) do you recommend to incorporate regular marketing activities into the forest-based industries in the Philippines? What unit should conduct the research and how should it be administered and funded?
7. Explain the selection process for the 23 LUS incorporated into your questionnaire for the Philippine Wood Processors survey.
8. If you could test market a limited number of LUS (with the greatest potential for economic success) for the Philippine market, which spp. and/or spp. groups would you select and why?
9. If you could test market a limited number of LUS (with the greatest potential for economic success) for the US market, which spp. and/or spp. groups would you select and why?
10. From the *resource perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
11. From a *marketing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
12. From a *manufacturing perspective*, what are the major impediments to improved utilization of LUS by the Philippine forest-based industries?
13. How do administrative policies either enhance or impede improved utilization of LUS by the Philippine forest-based industries?
14. Can you recommend a proactive strategy for dealing effectively with environmental groups regarding the harvest, utilization, and marketing of LUS?

15. In your opinion, who is/are the major beneficiary(ies) of this research? Please explain.
16. What were the lessons learned from the project?
17. How well did the project serve its intent?
18. Clarify the impact of the project today and in the future.
19. How much of the gained knowledge is transferable to other tropical timber producing countries?
20. Identify unexpected results.
21. Was the funding adequate to complete the planned work?
22. Identify difficulties encountered with the ITTO proposal & project reporting procedures and requirements.
23. Identify further research and development needs.
24. Do you plan to seek additional funding from ITTO to continue the research?
25. Did the project illuminate new challenges that should be examined when designing future studies? Please explain.

POLICY ISSUES –

LIST OF QUESTIONS FOR GOVERNMENT OFFICIALS:

1. What policies hamper the improved utilization of LUS in the Philippines?
2. What recommendations do you have for administrative policy reform to foster the utilization of LUS?
3. Do you think it is important for DENR to review its policies on diameter limits (60 cm inside TLA's) to help utilize LUS in the Philippines? If so, how can the scientific community persuade environmentalists that this is a rational policy?
4. Has this FPRDI-ITTO study provided adequate information for policy change with regard to improved harvesting, utilization, processing, and marketing and of LUS in the Philippines?
5. How will the "Manual on the Properties and Uses of LUS of Philippine Timbers" and the "Field Guide to the ID of Important LUS of Philippine Timbers" effect on forest management administrative policy.
6. Should the FPRDI marketing and promotion group assemble a marketing of LUS advisory board? If so, who should be included on the board?
7. What is the biggest impediment to the increased utilization of LUS in the Philippines?
8. What other issues related to the utilization of LUS should be studied by the FPRDI?
9. Is it the role of government to help Philippine producers adopt small log technology (for harvesting and processing) to improve the utilization of LUS? Please explain.

INDUSTRY ISSUES –

LIST OF QUESTIONS FOR MANUFACTURERS FROM THE FOREST-BASED INDUSTRY (TECHNOLOGY ADOPTERS AND PILOT PLANTS):

1. What specific LUS species have you piloted? For what products? With what new or modified technologies?
2. What information did you receive from FPRDI that made you decide to pilot the technology/products from LUS?
3. How did you make the go/no go decision to be a pilot plant?
4. How long have you been manufacturing the product(s) from LUS?
5. Is/are the product(s) profitable? If not, why not and why are you producing in?
6. Are you marketing domestically or exporting the product(s) made from LUS? What are your future plans for marketing products produced from LUS?
7. Do you have plans to expand or terminate production of the products produced from LUS?
8. Please explain the supply and demand of the product(s) you produce from LUS.
9. Are you promoting the product(s) made from LUS? Please explain.
10. Would you like FPRDI to conduct further research on the utilization of LUS? Should they research other LUS or conduct further studies on the species identified in the completed project?
11. Should the FPRDI conduct regular market research studies? If so, which of the following general topics should be addressed (please rate the following topics):
 - a. Perceptions of the Philippine forest-based industries on various issues;
 - b. Utilization of LUS by the forest industry;
 - c. Domestic markets for LUS;
 - d. International markets for LUS;
12. What is the biggest impediment to the increased utilization of LUS in the Philippines?
13. What other issues related to the utilization of LUS should be studied by the FPRDI?
14. Should the FPRDI marketing and promotion group assemble a marketing of LUS advisory board? If so, who should be included on the board?

ANNEX C – Itinerary of Travel of the Evaluator (Dr. Paul M. Smith)

DAY	ACTIVITIES	PERSONNEL INVOLVED
Day 1 – February 24, 2000 (Thursday) (arrive Manila 05:00)	A.M. – Meetings with Project Mgmt., Study Leaders, Consultants Lunch Project review meetings continue Tour visit of FPRDI lab including pilot projects, sample products, and related technology transfer research.	Dr. Florentino O. Tesoro - Director Dr. E.D. Bello – Project Leader Eng. A.P. Mosteiro – Asst. Proj. Leader All Study Leaders
Day 2 – February 25, 2000 (Friday)	National Holiday	
Day 3 – February 26, 2000 (Saturday) Saturday Evening	Visit of handicrafts in Laguna Ligaya Arts Craft, Paete, Laguna E&R Handicrafts, Pakil, Laguna The Armada Crafts, Los Banos, Laguna. Dinner party with UPLB faculty to discuss FPRDI/ITTO-related research (production side of the LUS research project)	Ligaya M. Adelfuin, General Mgr., Noel, Mgr. Mr. Rodel, owner Efren C. and Dory B. Armada, Owners, Dr. Elvira Fernandez, Head, Dept. of Forest Products and Paper Science; Dr. Lucrecio L. Rebugio, Dean, College of Forestry and Natural Resources; Plus other faculty in the CNR
Day 4 – February 27, 2000 (Sunday)		
Day 5 – February 28, 2000 (Monday)	Cavite Woodworks Association, Silang, Cavite	Ms. Noly D. Guevara, Provincial Trade & Industry Officer
Day 6 – February 29, 2000 (Tuesday)	Philippine Wood Producers Association, Makati City (Manila)	Antonio G. Bernas, Chairman of the Board, Fernando A. Lu, President Felix T. Tamesis, VP Timber Jose A. Lorenzo, VP Forestry, IFP & Environment
Day 7 – March 1, 2000 (Wednesday)	Dialogue with Exhibitors at the Philippine International Furniture Show 2000, World Trade Center, Roxas Boulevard, Metro Manila	Emmanuel P. Padiernos, President, Chamber of Furniture Industries of the Philippines (CFIP) and President & CEO of Pacific Arts and Décor International, Inc. Frocy G. Pascual, VP, Golden Cane Furniture Mfg., Corp. Felix and Catherine Sicangco Hagad, Owners, Art Energy Architecture & Contemporary Crafts Plus Many other exhibitors
Day 8 – March 2, 2000 Depart 21:45	Department of Environment and Natural Resources (DENR), Planning & Policy Studies Office, Quezon City (Manila)	Dir. Eriberto Argete, Director for Planning & Policy Monina M. Cunanan, Development Management Officer IV

ANNEX D
RESPONSES TO PRE-TRAVEL QUESTIONS

QUESTIONS FOR PROJECT ADMINISTRATORS

I. How does the project relate to the:

A. Sustainability of the Philippine forest resource?

The project is related to the sustainability of the Philippine forest resource considering that its primary focus is on the identification of important lesser-used species (LUS) of Philippine timbers with substantial stand (approximately 1.5 to 5.0 cu. m. per hectare or about 3 to 17 trees per hectare) that will be investigated on their basic and working properties and characteristics. Based from their properties, some specific end-uses or products would be identified and developed. The utilization of these LUS would help relieve the pressure on the over exploitation of the traditionally used CTS. Considering also that as of 1996, there are about 57.93 million cubic m. of miscellaneous species of 15 cm. and up in DBH and about 50 million cubic m. of LUS (light hard woods) that are being elevated to commercial status or a total of about 107.93 million cubic m., thus by utilizing such volume of LUS on a planned harvesting program will help conserve the commercial Philippine dipterocarp trees and thereby contributing to the sustainability of the forest resource.

B. Improved efficiency of wood utilization?

The project is related to the improved efficiency of wood utilization considering the results of the various studies on the determination and classification of the physical and mechanical properties, anatomical, chemical, durability of LUS would help enhance the selection of a particular end-use. Similarly, by improving the lumber recovery and utilizing less manpower in sawing LUS by employing smaller and thinner saw blades in sawmilling LUS would also improve efficiency of utilization. By using the High Pressure Sap Displacement Method of treating freshly cut LUS for utility poles greatly enhance utilization of LUS. Knowing the classification of the drying, machining, finishing, gluing and bending properties of LUS would greatly improve its utilization efficiency. In a nutshell, the

information generated by the project on the characterization, processing and product development using LUS would help enhance utilization efficiency.

C. Policies of the Philippine government

The Department of Environment and Natural Resources (DENR) supports the optimum utilization of the resources within a given forest land area, i.e.: from extraction to processing of logs into finished products. The use of LUS as a substitute to commercial wood is seen as a way to optimize forest resources utilization. This will also broaden the resource-base of the forest products industries and consequently reduce the pressure on the over exploited commercial species. Although the DENR has no clear-cut policy on LUS, it encourages the use of LUS. E.Q. 192 of 1987 states that the operation of the forestry sector is guided by the following policy thrusts of DENR:

1. Sustainable development of forest resources
2. Optimal utilization of forest lands
3. Social equity and efficiency of forest resources use
4. Effective forest management

Supportive of these policies and cognizant of the importance of wood in the national economy, the government has adopted the following strategies:

1. Promote the development and utilization of LUS as well as minor forest products as supplemental raw materials source for the wood and other forest-based industries
2. Determine optimal distribution and location of processing plants relative to raw material source, transportation network and market outlet
3. Undertake upgrading of timber extraction equipment considering new mix of available raw materials as well as improved efficiency and product quality

The Master Plan for Forestry Development also provides programs for LUS.

II. What criteria were used to arrive at the selected approach? That is the:

A. Objectives of the study

The criteria used to arrive at the objective of the study are:

1. That the said objectives should specifically address the problems or issues that the study is trying to solve
2. That specific outputs should be developed or generated by the study
3. That verifiable indicator and means of verification are available to verify the results to support the objectives.

B. LUS selected for inclusion

The criteria used for the selection of the wood species to include in the project are:

1. That the volume of the wood species should be at least 1.6 cu. M. per hectare or about 2 trees per hectare in the residual forest (RP-German Forest Resources Inventory 1988).
2. Species that were evaluated/listed in the Final Report (1990 FDC) of ITTO Pre-Project entitled "Appropriate Supply of Wood Raw Materials in Producing Countries with Dwindling Forest Resources: The Case of the Philippines"
3. State of the Art Research and Utilization of Lesser-Known Species of Philippine Woods (1978)

C. Species/group of species, products and technologies selected for pilot plant research (Beng)

D. Target population for primary data collection in the marketing research component (Emelyne)

III. How was the environmental impact of the project considered?

The project in itself has no component to assess its environmental impact. However, after the completion of the project, the initial effect of harvesting LUS on the social environment was given particular attention. With the information gathered from 8 Timber Licensee's (TLA holders) in the Philippines the small percentage of 9.8% of LUS harvested in their areas has little impact on the environment and the forest inhabitants. In the future, if the harvesting or extraction of LUS will not be regulated by the government, it is expected that the impact would be significant.

IV. What measures are being taken to ensure local community participation?

In the project, there are no specific measure or activities to ensure the participation of local communities in the project. However, during the implementation of the project, some upland forest dwellers who were formers employees of the company/ TLA holders were particularly involved in some specific activities of the project specifically in harvesting and transport of LUS from the forest to plant site. Some were also involved in the sawmilling of logs into lumber.

V. Can the value of the developed products be quantified?

Yes.

VI. How were the utilization of new species and products enhanced?

Considering the present level of LUS harvesting and utilization by the wood industry that is still very low, the enhancement of species utilization and products could not be significantly felt or visualized at the moment.

VII. What new innovative technologies (method of processing) were introduced and enhanced?

One of the innovative methods of processing LUS was the use of small mobile horizontal band sawmill that could be brought to the cutting area to saw LUS logs into lumber. Another innovative processing method was the use of the High Pressure Sap Displacement Method of treating freshly cut logs for electric power and communication poles. Logs need not be subjected to the usual drying process prior to chemical preservative treatment.

VIII. What is the socio-economic impact of harvesting LUS on the collection and utilization of industrial non-industrial non-wood forest products by local forest dwellers?

Considering the eight timber licenses visited, the collection of LUS is not widely practiced yet. However, the collection of LUS arouses apprehension among forest dwellers because of the decreasing volume of non-wood forest products in the concession area and the increasing distance of the collection site from the forest dweller homes or dwelling areas, resulting to excessive migration.

In some areas, the opening of forest in terms of logging and construction roads is advantageous to the forest dwellers for easy collection of forest products. Other forest occupants, who are mostly hunters of wild animals, logging including collection of some LUS does not have any adverse effect on their activities.

IX. What were the lessons learned from the project?

Some of the lessons learned from the project were:

- A. Development lessons
- B. Operational lessons

Under development lessons, it is evident that after five years of project implementation, the work plan was carried out smoothly as per planned targets. Based on the output obtained, it is clear that the development objective of the project was attained. This has indicated that the project design is very appropriate and its implementation is likewise successful. It was also learned that the ITTO was very supportive to the project not only on the release of funds, but also on the project monitoring, review, and evaluation (State also page 28 of PC Report).

Under operational lessons, it was learned that the successful implementation of the project was made possible through the effective and proper guidance of the Project Steering Committee and critical review and evaluation of the ITTO and Local Project Monitoring and Evaluation of the various activities of the project. It was also learned that the dedicated services and effort of the project administrators and the cooperation and support of the individual study leaders led significantly to the attainment of the project objectives and contributed to the success of the project. (State also page 29 of PC Report).

X. How well did the project serve its intent?

Considering that the specific objective of the project have been achieved and that the expected outputs have been attained, the project serves its intent quite well.

XI. Clarify the impact of the project today and in the future?

After two years that the project had been completed, the impact of the project at present could not be felt significantly particularly by the wood industry sector. Considering the very low level of LUS extraction, ranging from 5% to 15% from the residual forest, the impact of the project is expected to be minimal.

XII. How much if the gained knowledge is transferable to other tropical timber producing countries?

Most of the knowledge gained from the project is transferable to other tropical timber producing countries. Such knowledge/technologies are on the characterization of some important LUS; grouping of LUS for specific end-use; and development of important economic products using LUS.

XIII. Identify unexpected results.

XIV. Was the funding adequate to complete the project?

Yes

XV. Identify difficulties encountered in the ITTO Proposal and Project Reporting Procedures and Requirements.

So far we didn't encounter difficulties.

XVI. Identify further R & D needs.

R & D on forest production should be pursued. The LUS identified and tested to possess the desired properties for the manufacture of high value-added products such as furniture, molding, novelty products, handicraft, millworks and joinery should be propagated.

XVII. Do you plan to seek additional funding from ITTO to continue the research?

Yes. The concerned proponent agency should seek funding from ITTO to support the project proposal.

XVIII. Identify the key obstacles in the way of adaptation of the developed products and technologies.

- A. The low volume of LUS being harvested in timber concession areas that is about 9.8%, resulting in an inadequate supply of LUS lumber in the market.
- B. Also, inadequate processing facilities particularly in the cottage and small scale processing shops.
- C. Most of the small-scale wood processing enterprises are not yet fully aware of the output generated by the project.

IXX. Should the FPRDI marketing and promotion group assemble a marketing of LUS advisory board? If so, who will be included on the board?

This is a matter that FPRDI management will have to decide.

XX. What is the biggest impediment to the increased utilization of LUS in the Philippines?

The absence of a clear-cut policy of the government represented by the DENR is a big impediment to the increased utilization of LUS in the country. The policy should explicitly address the harvest and transport of LUS from the second-growth forests. Such policy would help promote the efficient use of LUS and support the development of a sustainable forest management policy at the national level.

XXI. What other issues related to LUS utilization should be studied by FPRDI?

- A. Further investigation on other LUS aside from those 22 LUS studied on the gaps as far as their properties are concerned
- B. An effective market information dissemination strategy should be looked into to improve marketing of LUS

MARKETING PERSPECTIVE

What are the major impediments to improved utilization of LUS by the forest-based industries

I. Availability of supply in commercial quantities?

Production of lumber, furniture, handicrafts, woodworks, etc. demands sustainable supply of raw materials. Collection of these species is difficult because these are not located in one area alone. It is difficult to promote utilization of species if resource based is not assured.

II. DENR Policy

There is a problem on harvesting and transporting of LUS as there is no government regulations that allow utilization of LUS for large-scale timber operations, except in community based related activities. Only a few timber companies are allowed to operated in their operable residual forest areas after complying with a litany of environmentally related prerequisites.

There are regulations that allow harvesting of LUS from residual forests but there is a problem on the diameter limit.

There is a need to formulate/develop policy addressed to harvesting and transporting lesser-used species derived from second-growth forests. The policy will help promote the more efficient utilization of a sustainable forest management policy at the national level and provide a mechanism to address the raw material shortages currently confronting the domestic value-added wood products industry.

III. What are the challenges associated with processing LUS

There is a problem on the processing of LUS. Additional investment had to be injected by a firm for the acquisition of new sets of machinery and equipment. Retooling has to be done because LUS species are mostly small-diameter logs.

Related to processing, some of the wood processors lack the technical information on properties of LUS. They are a bit hesitant to try the species because processing the species into desire finished products entails cost.

IV. Recommendations:

- A. There should be a clear-cut policy or guideline to encourage utilization of LUS
- B. Aggressive promotion or information dissemination on the utilization of LUS
- C. Encourage plantation establishment of identified LUS that meet the silvicultural and economic criteria for plantation forestry.

PROCESSING ISSUES

- I. In your opinion which of the LUS tested show the most promise for becoming economically viable spp. and/or spp. group for the Philippine Forest Industry? What specific high value added products show the most promise?**
- A. Most promising group of species
 - 1. Syzygium
 - 2. Palaquim
 - B. Promising high value added products
 - 1. Veneer and plywood
 - 2. Furniture and joineries
 - 3. Parquet
 - 4. Electric poles
- II. What lessons were learned in the piloting of LUS for the major end-use applications listed above in Studies 14-20?**
- A. Although substantial R & D-based information has been generated and disseminated by FPRDI during the past two decades and more, during the implementation of this ITTO Project on LUS, actual adoption of LUS as an alternative raw material remains problematic. Hence, the need for more sustained/continuing information dissemination and promotion program initiated by this project.
 - B. The “risk-averse and wait and see” attitude of target and potential adapters and cooperators should be taken as a major consideration and utmost care in the selection of first adapters of new technologies. Thus, the successful piloting of the end-use application of the selected LUS will facilitate its adoption in other shops and eventual commercialization.
 - C. The problem in identifying cooperator(s) for the piloting of selected LUS application was compounded by the lack of reliable information on the availability and accessibility of selected species at the project site.

- D. There is still a strong public resistance in accepting LUS as an alternative material to commercial wood products. However, the dwindling supply of commercial species is now a plus factor in the eventual acceptance of LUS doe high value products.

III. If you could select the major LUS and product for testing today, how would your selection differ and why? What did you learn from the project?

- A. Selected end-use application would be veneer and plywood and woodwool cement board or furniture instead of electric poles and parquet. The use of LUS for electric poles at present will fact the following constraints:
1. Present government policies favors the use of plantation species over species from natural forest.
 2. Cutting of small diameter logs (less than 60 cm.) in natural forests is still banned. It is very difficult to obtain a special permit to cut pole materials in public forests. Piloting of the processing of LUS for furniture at present will be a lot easier today than during the project implementation. Because of the shortage of raw materials for the veneer and plywood and furniture industry, any suitable local substitute will be most welcome by the industry. Imported LUS and plantation species accounts for more than 50% of the wood requirements of the local wood industry. Woodwool manufacturers can process practically most LUS.
- B. Promoting new materials such as LUS for high value added products needs a lot of input, not only technical data, but more important is the sustainability of supply and continuing cooperation and collaboration of the major stake holders- producers, processors and manufacturers and importers/buyers. A follow-up project on the commercialization and marketing of LUS should be encouraged.

PROPERTIES CHARACTERIZATION ISSUES OBJECTIVES NOS. 3, 4, AND 8

- I. In your opinion, which of the LUS tested show the most promise for becoming economically viable for the Philippine Forest Industry? What specific high value-added products show the most promise?**

The species are Nato, Ulaian, malak-malak, duguan, magabuyo, balakat, bitanghol, sagimsim and malugai-liitan. The products are furniture, floor parquet, louver doors, molding and other builders' woodworks.

- II. What geographic location in the Philippines shows the most promise for using LUS as alternative raw materials for the forest-based industry? Why?**

The geographic locations are Carago Region, Region II, Cebu and Pampanga. The two regions are the places where supply of LUS are situated. Cebu and Pampanga are the two places in the country where manufacturing plants/companies are presently situated.

- III. What success stories do you have regarding the transfer of technology from this project to the forest-based industries?**

- A. A total of ten technology investors for clinic/consultative dialogues on the processing and utilization of LUS were organized and conducted in seven regions in the Philippines.
- B. LUS manufactured products in the form of balusters, louvers, parquet, furniture, solid doors and turned products were exhibited/displayed in three major fairs and conference in Manila and Los Banos, Laguna.
- C. Radio and television interviews and press releases on the utilization of LUS were presented on six radio stations and one television station.
- D. Actual technical assistance in LUS processing and utilization were conducted in three timber industries/corporation and Agrarian reform community project.

IV. Explain the selection process for the 22 species.

- A. The availability/volume of LUS based from the FCD report (1990) and the report of the RP-German Forest Resources Inventory in 1988.
- B. That the LUS diameter should be at least 30 cm. and are presently available in the forest concession areas of TLA holders in the Philippines.
- C. That TLA holders would be willing to act as cooperators of the project.

V. If you could select 22 LUS for property testing today, how would your selection differ and why? What did you learn from the project?

If the policy of the government (DENR) would not change, the selection of LUS would not differ. Similarly, if the volume of LUS in the forest will change, then the selection will also change.

For example, if the DENR would reduce the diameter limit from 60 cm. down to 30 cm., then the selection would differ. Although there are a number of products that can be developed but the supply of LUS might be a factor.

VI. From the resource perspective, what are the major impediments to improved utilization of LUS?

It is common knowledge that the distribution of LUS in the Philippines are scattered in the forest but their availability/stand per hectare is limited compare to CTS so that the collection of LUS would be an impediment.

The imposition of the diameter limit of 60 cm. in cutting timber by the DENR may also be an impediment to the utilization of LUS by the forest-based industries.

VII. From a marketing perspective, what are the major impediments to improved utilization of LUS? (Emelyne)

VIII. From the manufacturing perspective, what are the major impediments?

The inadequate equipment facilities particularly the small-scale wood industries in the Philippines to cater to the processing of LUS is an impediment in processing LUS. In the large-scale wood processing industries the existence of bigger wood working machines/equipment used to process bigger CTS might be an impediment in processing LUS.

IX. How do administrative policies either enhance or impede improved utilization of LUS in Philippine FBI?

A specific and clear-cut policy or guidelines of government concerning the utilization of LUS would greatly enhance the collection and utilization of LUS.

At present the government states that it supports the utilization of LUS to augment the supply of industrial wood in the country but it has no clear-cut policy statement/guideline on the collection and utilization of LUS.

X. Can you recommend a proactive strategy for dealing effectively environmental groups regarding harvesting, utilization and marketing of LUS?

- A. The establishment of LUS plantation in suitable areas
- B. Harvesting should be done only in authorized logging areas
- C. Cutting should be done strictly on a sustainable basis

XI. What are the socio-economic impacts of harvesting LUS on the collection and utilization non-wood forest products by local forest dweller?

Refer to page 10 of PC Report

XII. What lessons did you learn from characterizing the properties and end-uses of 39 LUS as illustrated in the manual?

From the data and information obtained from the LUS listed in the manual, it could be seen or deduced that most of the properties approximates if not equal the

properties of the CTS. That the identified end-uses of most LUS tested are more or less similar end-uses of CTS.

XIII. What lessons did you learn from developing the manual that would facilitate another project? Did any problems arise?

There are a number of LUS aside from the 39 listed in the manual that we have studies that were found to have some gaps. To fill these information gaps would need some research activities. So far no major problems have arisen.

XIV. In your opinion who are the major beneficiaries of this research? Explain.

- A. Furniture and woodcraft manufacturers
- B. Housing construction industry (Lumber and Plywood)
- C. Power and utilities sector (Poles)

Considering the results obtained from the project ranging from tree characterization, wood description, technological and working properties classification, and description and end-use classifications, the furniture makers, woodcraft processors, housing contractor, homeowners and future homeowners will have a definite guide to choose which particular LUS would qualify or be especially suited for their purpose or product. Knowing the working properties of LUS would likewise enhance processing and quality of finished products.

XV. Did the project illuminate new challenges that should be examined when designing future studies? Explain.

Yes. It illuminated new challenges particularly in the characterization of LUS with regard to their strength properties, machining properties, sawmilling treatability and

drying characteristics. The project indicated that characterization could be based on the density of the species. It is not necessary to test the species individually. Grouping the density levels and then getting a representative species for each group of density level would be sufficient.

XVI. In your opinion, what are the key lessons learned from the project?

- A. Some LUS are already being utilized by some small-scale companies for furniture, furniture components, and handicraft. Some LUS are being used for veneer and plywood by some plywood companies.
- B. The basic and technological properties of LUS approximate the properties of CTS. This is indicative that LUS can be used as an alternative raw material for the traditionally used CTS used by the industry.
- C. That based from the report of Dr Eastin on the development of a Strategic Framework for LUS in the Philippines it indicated that most managers of the wood industry would be willing to try using LUS in their manufacturing operations.

ITTO EVALUATION

I. What success stories do you have regarding the transfer of technology from this project to the forest-based industries in the Philippines?

During the project period covered, technology transfer activities focused more in the conduct of an intensified information campaign to promote/market LUS as an alternative raw material considering that LUS processing and utilization is still new and still not accepted by the majority of wood producers, manufacturers, and end-users in the Philippines. This is shown by the following accomplishments:

- A. Production and information dissemination of “Manual on technical properties and potential uses of some LUS found in the Philippines”, “Fact sheets of LUS”, “FPRDI-ITTO services on LUS processing and utilization to the forest-based industries”, and prototypes of value-added LUS products.
- B. Conduct of ten technology investors for a consultative/industry dialogues in seven regional centers (Regions 2, 3, 4, 5, NCR, Carago, and 11) which were participated in by 257 participants representing the furniture, handicraft, builders woodworks, forest-based communities, and wood producing sectors
- C. Conduct of five appreciation seminars of LUS processing and utilization to 160 professional forestry practitioners
- D. Conduct of three technology exhibition/demonstration in technology fairs
- E. Conduct of 13 radio interviews and one television interview/documentation in six national radio stations and one television station

Offshoots of these technology promotion/marketing activities are several requests for technical assistance such as consultancy and advisory services, technology installation and training/demonstration services related to LUS processing and

utilization. Although the project has terminated at EO 1997, several inquiries and requests for technical assistance have been received by the Institute related to LUS utilization. At present, the Technical Services staff (TSS) has been tasked in coordinating and implementing appropriate action to address these technical problems/need by the industry sector under its Technology Transfer Program. The program's budget is very limited to intensify the promotion and transfer of LUS related processing technologies. A new project entitled "Technical Assistance to Agrarian Reform Communities in Agusan del Sur" is currently being implemented for CY 2000, which incorporates promotion/marketing of LUS in three ARC areas of Agusan del Sur in Carago region.

CLIENT/LOCATION/ REGION	TECHNICAL SERVICES RENDERED	DATE ASSISTED/STATUS OF ASSISTANCE
ARTIMCO, SUDECOR	Veneer and Plywood Manufacture	C/o Larry Dolores
Timber Industries of the Philippines (TIPI)/Molugan, El Salvador, Cagayan de Oro City/Region 10	Consultancy and advisory services on properties and suitability of 5 LUS (arrangen, balete, kulasi, ulaian, pototan) for high-grade pallets and rendered assistance on non-pressure treatment	1996 completed
Barangay Resources and Development Corp. Inc. (BREDCI) forest-based communities/Bgy. Buenavista, Presentacion, Camarines Sur/Region V	Consultancy and advisory service on efficient processing and utilization of available LUS in the BREDCI community forests through on-site assessment, promotion of appropriate technologies on LUS process/utilization	1997 completed
Agrarian Reform Communities (ARC) under the Agrarian Reform Support Project/Prosperidad, Agusan del Sur/CARAGA	Consultancy and advisory services on processing and utilization of LUS available in the 1400 hectares ARC area through on-site resource assessment, technology promotion and preparation of technical assistance program.	1997, 1999 completed
	Implementation of Project entitled "Technical Assistance to Agrarian Reform	January-December 2000

	Communities in Agusan del Sur”	
Cavite Woodworks Associated (CWA)/Bgy. Biga, Silang, Cavite/Region IV	Technical assistance on kiln drying and processing of some LUS for furniture	1998 completed
Ligaya Arts and Crafts Paete, Laguna/Region IV	Technical assistance on kiln drying and processing of some LUS for handicraft	1998 completed
Recuerdos Crafts International Salawag, Dasmariñas, Cavite/Region IV	Technical assistance of kiln drying and processing of some LUS for handicraft	1999 completed
Rosario Furniture and Handicraft Manufacturers Association/Rosario, La Union/Region I	Consultancy and advisory services on kiln drying and processing of LUS for furniture and handicraft	1999 completed

II. Explain the selection process for the 60 LUS?

- A. The list of LUS was provided by the project managers based on the pre-feasibility study conducted by the University of the Philippines, College of Forestry.
- B. Availability of supply or volume of the species
- C. Size of the species, i.e.: medium to large-sized trees (approximately 30 to 60 cm. diameter at breast height)

III. If you could select 60 species for identification and 22 species for property testing today, how would your selection differ and why? What did you learn from the project?

The foremost basis in selecting species for property testing would still be availability of supply or volume. There is no sense in selecting species that are rare. A fair amount of supply should be available for a particular LUS.

IV. What lessons did you learn from the collection, identification and authentication of LUS for herbarium use that would facilitate another project? Did any problem arise?

The distribution of LUS in a given tract of forest land is scattered. It is unlike the commercial dipterocarps species that tend to dominate. Also one is not sure whether a particular species of LUS is present in an area because they respond differently to edaphic factors and elevation. They are mixed and dominance is shared among several species.

An ideal sequel project is probably to conduct a resource survey and inventory of these economically useful and important LUS in the future to determine actual range of distribution, supply and volume.

V. What lessons did you learn from developing the “Field Guide to the Identification of Some LUS of Philippine Timbers”?

Writing and developing the guide required a lot of effort, particularly field work, to have an actual view of each species as it stands in the forest. Diagnostic field characters, say of the bark and bole especially, have to be noted carefully.

V. In your opinion, who is/are the major beneficiaries of this research? Explain.

With reference to the field guide, in our opinion, they are the people in the wood-using industry and also those in the academe. The guide can serve as a handy reference in identifying correctly LUS in the forest by company foresters and those engaged in the teaching of dendrology in forestry colleges.

VI. What geographic locations in the Philippines show the most promise for using LUS as an alternative material in the wood-based industry? Why?

Industries located near areas of resource like eastern Mindanao and northeastern Luzon where forests are still present. Also at the centers of wood-using industry like Cebu and in and around Metro Manila. Because alternative material with known technical properties are now available for their use.

VII. Did the project illuminate new challenges that should be examined when designing future studies? Explain.

The project does illuminate new challenges in future studies. With regard to the resource, LUS presents a bit of a problem in identification in the field because they are mixed with other species. If present, they are not gregarious unlike the commercial dipterocarp species.

VIII. In your opinion, what are the key lessons learned from the project?

With reference to the field guide, there is still an inherent difficulty of identifying the 60 species because they are mixed with the over 2,000 tree species growing in the forest. The fact is that in a dipterocarp forest about 80-90% volume are composed of dipterocarp species, about 70% of which comes from the so called "Philippine mahogany" species composed of six species. Thirty percent volume of standing timber comes from the over 2,000 species of which 60 LUS were studied.

QUESTIONS FOR GOVERNMENT OFFICIALS

I. What policies hamper the improved utilization of LUS in the Philippines?

None. The policy of the government in the forestry sector is geared towards sustainable management and development of the country's forest resources. Hence, enhancing forest productivity is one of the objectives to achieve the goal of sustainable forest management, which is to bring, in a practical and feasible manner, a condition of sustainable yield with accompanying environmental stability for the benefit of a greater proportion of the population, in ways that are economically beneficial, environmentally sound, and politically, socially and culturally acceptable.

The strategy to enhance productivity is by increasing outputs both physical as well as economic terms on a sustainable basis. This involves the maintenance of an appropriate level of production from the forest while activities to promote increased productivity are being carried out. The strategy includes not only long-term increase in production of commercial species, whether timber or non-timber but also encouraging the utilization of the lesser-used species.

The Master Plan for Forest Development (MPFD) provides that the wood-based industries program is geared to developing industries that will be able to satisfy the growing needs for wood products. This could be achieved through rationalization, provision of new technologies, promotion of processing and downstream industries, development of community-based wood processing industries.

Also in the Medium Term Philippine Development Plan (MTPDP 1999-2004) the improved utilization of LUS is incorporated in important activities under the Priority Sector Activities (PSA). Among the activities identified are:

- A. The production and utilization of lesser known forest species
- B. Generation of technologies on commercial utilization of LUS

II. What recommendations do you have for administrative policy reform to foster the utilization of LUS?

Utilization of LUS is already addressed by the Department through the implementation of the Executive No. 265 of 1995 (Adopting Community-based Forest Management-CBFM-as the National Strategy for Sustainable Forest Management), wherein the communities were given resources use rights for protection, rehabilitation, development, conservation and management of the forest resources provided they employ environment-friendly, ecologically sustainable and labor-intensive harvesting methods.

This is implemented through the issuance of Memorandum Circular No. 12 Series of 1997 (Guidelines for the Formulation of Community Resource Management Framework and Annual Work Plan for CBFM). The said circular provides that one of the guiding principles in the formulation of the CRMF and AWP is the effective resource utilization where plantation timber species, non-timber forest resources and lesser-used species are given priority in the utilization and extraction activities within CBFM area. The inclusion of the Resource use Plan (RUP) in AWP is a requirement in case extraction shall be undertaken within the CRMF. The RUP, which serves as the permit to utilize the resources, shall present forest products to be utilized, approximate quantity of resources to be utilized, methods of resource usage or harvesting, planned development of extracted resources and marketing of resources services or products.

Also, by virtue of Executive Order No. 786, the Natural Resources Development Corporation (NRDC) was tasked to promote and undertake the development and use of technologies and systems that complement the utilization of natural resources, including forest resources. The reorganization of the NRDC under Executive Order No. 192 of 1987 gave NRDC the responsibility of promoting natural resource development and conservation through direct involvement in pioneering but

potentially viable product, use, and marketing ventures or projects using new/innovative technologies, systems, and strategies such as, but not limited to, stumpage sales system, industrial forest plantation or logging operations.

- III. Do you think it is important for DENR to review its policies on diameter limits (60 cm. inside TLAs) to help utilize LUS in the Philippines? If so, how can the scientific community persuade environmentalists that this is a rational policy?**
- IV. Has this FPRDI-ITTO study provided adequate information for policy change with regard to improved harvesting, utilization, processing, and marketing and of LUS in the Philippines?**
- V. How will the “Manual of Properties and Uses of LUS of Philippine Timbers” and the “Field Guide to the ID of Important LUS of the Philippine Timbers” effect the forest management administrative policy?**

In formulating an administrative policy it is important to determine the extent and the characteristics of the certain issues on LUS, hence these manuals on properties, uses and identification of important LUS serve as reference to the policy makers. The properties, characteristics and uses of the LUS are indicators in determining its suitability for a particular end-use or product. Further, these manuals aid in the determination of improving wood quality and serviceability.

Further the dissemination of these references is one of the strategies in the promotion of encouraging the processors and end-users to try these species.

- VI. Should the FPRDI marketing and promotion group assemble a marketing of LUS advisory board” If so, who should be included on the board?**

In a way, it is agreeable for FPRDI marketing and promotion group to assemble a marketing of LUS Advisory Board in order to address the issues, problems and concern regarding LUS. However, this entails additional funds on the part of the FPRDI.

Composition of the board may include official or his appropriate representative from the following:

- A. FPRDI
- B. DENR
- C. Forest management Bureau
- D. DTI
- E. Representative(s) from the major value-added forest products company
- F. Others

VII. What is the biggest impediment to the increased utilization of LUS in the Philippines?

Increased utilization of LUS would mean reorientation in the industry in terms of equipment and processing technologies because of the change in the physical characteristics and mechanical properties of the species. Hence even the profitability of the industry will also change. Further, there will also change in the processing sectors, thus retooling in the industry needs to be pursued.

VIII. What other issues related to the utilization of LUS should be studied by the FPRDI?

For the best advantage of sustainable development there is a need to further study extensively the physical and mechanical properties particular uses of each LUS. The best approach would be to classify them according to density/specific gravity classes and the uses of each class should be determined. The above measure would help in the utilization technology for LUS.

IX. Is it the role of government to help producers adopt small log technology (for harvesting and processing) to improve the utilization of LUS? Explain.

The Department may help through the NRDC. Under EO 192, NRDC is financing natural resource development projects undertaken by the private sector such as establishing industrial tree plantations, agroforestry and retooling of the natural based processing industries to improve their efficiency and competitiveness. To discharge this function effectively, NRDC is authorized to generate funds through debt instruments from various sources and income-generating strategies.

**ANNEX E – Promotional Brochure – ‘Promotion and Technical Assistance Services
on Processing and Utilization of Lesser-Used Species.**

- * *High Pressure Sap Displacement Treatment of Power and Telecommunication Poles*

HOW TO AVAIL OF FPRDI SERVICES

Interested parties must send formal written request to FPRDI with brief statement about the company profile, technological problems / needs encountered, and the nature/ coverage of technical assistance services desired. FPRDI will act accordingly on the basis of the request.

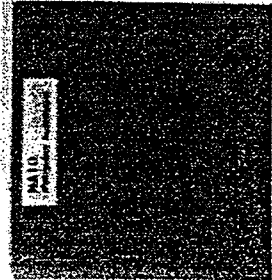
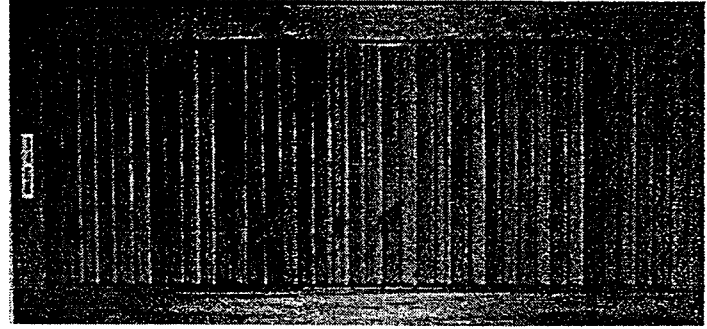
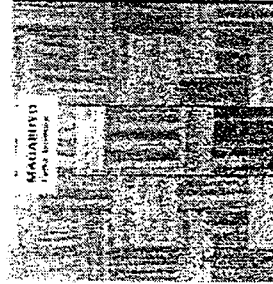
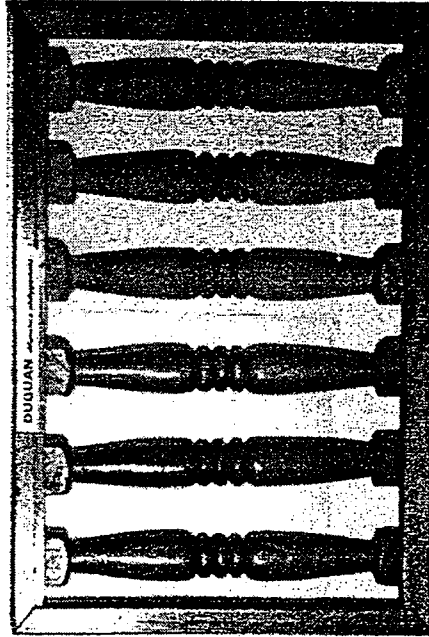
ALL INQUIRES SHOULD BE ADDRESSED TO :

Director
 Forest Products Research and Development Institute
 College, Laguna 4031
 Philippines

Attention: Engr. Arnaldo P. Mosteiro
 Asst. Project Leader
 ITTO PD 47/88 Rev.3(1)

Tel.: (049) 536-3630/2586/2360
 Fax.: (63) (049) 536-3630

SOME WOOD PRODUCTS FROM LVS



FPRDI



ITTO

PROMOTION AND TECHNICAL ASSISTANCE SERVICES ON PROCESSING AND UTILIZATION OF LESSER-USED SPECIES



INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)
 Yokohama, Japan

FOREST PRODUCTS RESEARCH AND DEVELOPMENT INSTITUTE
 Department of Science and Technology
 College, Laguna 4031, Philippines

RATIONALE

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 both the Philippine government and the forest based industries. Cognizant of the need to conserve the remaining forests and the forest-based industries contribution to the national economy, the government has adopted policies to promote the development and utilization of lesser-used species (LUS) as alternative raw materials for the forest-based industries.

Although some LUS are now being processed by the wood-using industries into lumber, furniture, wares, builders woodworks and other suitable wood products, the industry is currently faced with technical problems in the area of botanical and wood identification, determination / assessment of wood properties, characteristics and suitable end-uses and efficiency in its processing considering the large number of LUS available in the Philippine forests which is estimated to be more than 2000 species.

It is in this context that the Forest Products Research and Development Institute (FPRDI), an agency under the Department of Science and Technology (DOST), and the International Tropical Timber Organization (ITTO) through PD 47/88 Rev.3(I) has conceived and financed

to implement a promotion and technical assistance program on LUS to help concerned clients from the forest-based industries solve technological problems they meet in their production system through technical advice, actual laboratory testing of wood materials and products, conduct of training courses, and transfer of commercially technologies. This in the long run will eventually help augment their raw material requirements and contribute towards the sustainable development of the country's forest resources.

NATURE & COVERAGE OF TECHNICAL ASSISTANCE SERVICES

The nature of FPRDI promotion and technical services consists of the following: 1) in-plant advisory and consultancy services; 2) wood testing and end-use/properties determination; 3) in-plant trainings and appreciation seminars; 4) delivery of commercially technologies; and 5) conduct of cooperative R & D projects. It covers the following technological areas of concern:

o Botanical and Wood Identification

o Wood Properties and End-Use

Determination

- * Anatomical Properties
- * Physical and Mechanical Properties
- * End-Use Properties
- * Structural Testing and Stress Grading

o Wood Quality Evaluation

- * Sawmilling Characteristics
- * Machining Properties
- * Drying Characteristics
- * Natural Durability Testing
- * Wood Preservation/Chemical Treatment
- * Wood Bending Quality
- * Finishing Properties
- * Pulping and Paper Properties

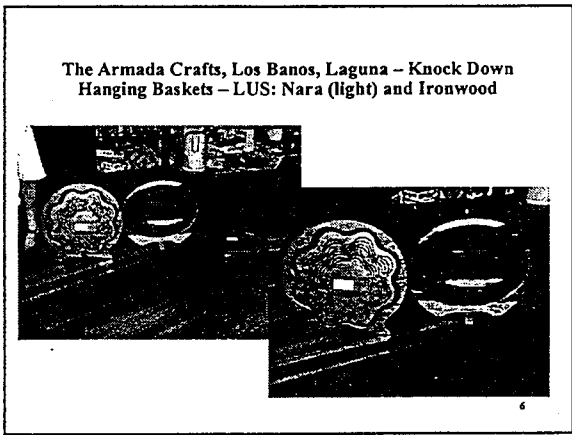
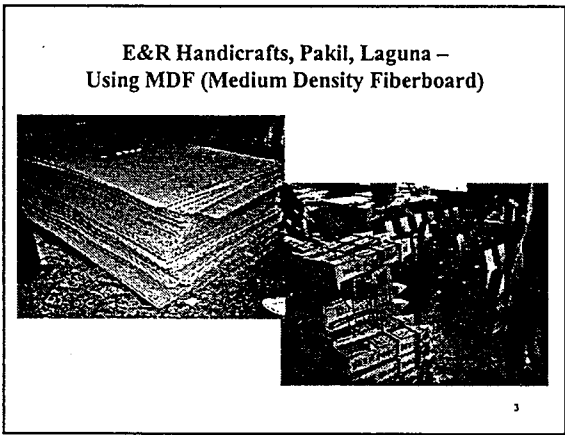
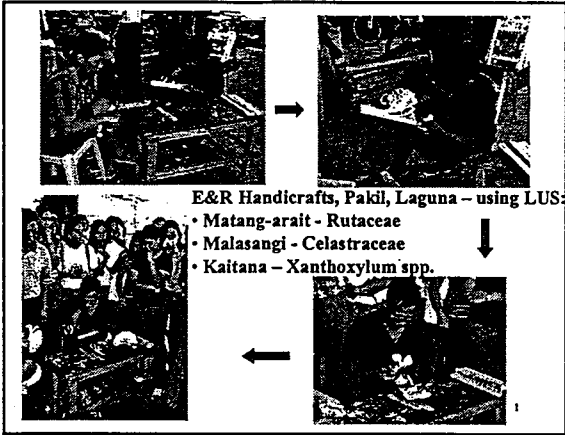
o Product Development

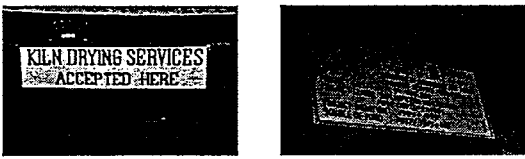
- * Furniture Manufacture
- * Parquet Panels and Textile Implements
- * Woodwool Cement Boards
- * Electric and Telecommunication Poles
- * Wood Pallets
- * Millworks and Joineries
- * Veneer & Plywood
- * Others

o Transfer of Commercially Technological (Design, Installation, Training)

- * Furnace-type Lumber Dryer
- * Solid and Laminated Wood bending
- * Finishing Facilities (Drying Tunnel, Spray Booth)
- * Special Effects Coating Systems on Wood Finishing

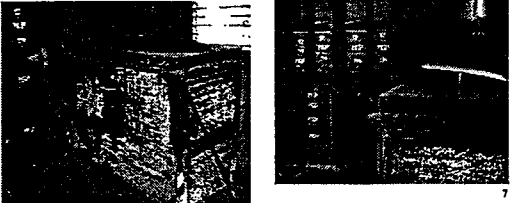
ANNEX F – Photographs Showing LUS Product and Technology Applications.






KILN DRYING SERVICES
ACCEPTED HERE

Kiln Drying Services – Dept. of Trade & Industry, Silang, Cavite

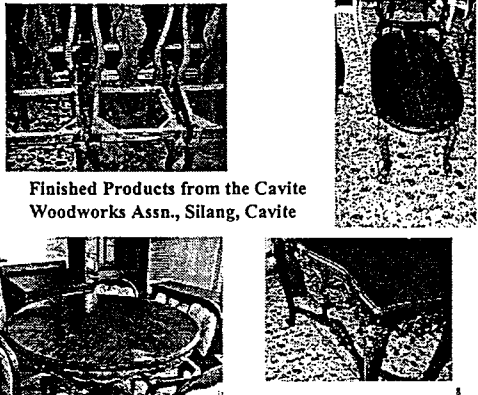


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FPRDI – LUS Samples




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Finished Products from the Cavite Woodworks Assn., Silang, Cavite

8

View of Manila Harbor

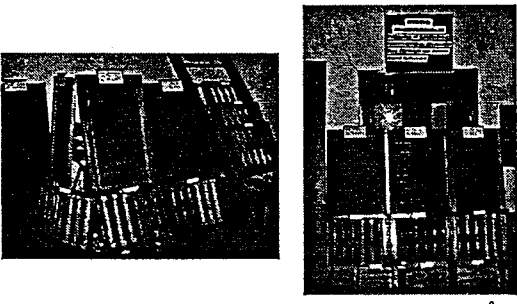


Scenic View -



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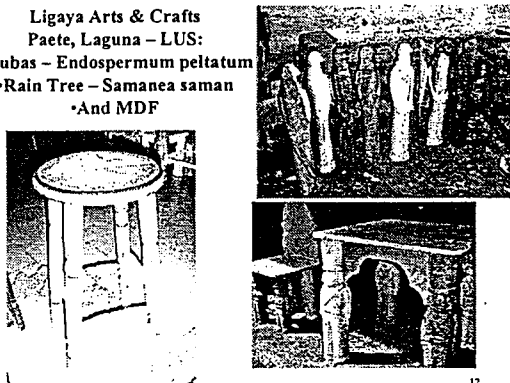
FPRDI – LUS pilot products – shutters, turnings, pallets



9

Ligaya Arts & Crafts Paete, Laguna – LUS:

- Gubas – *Endospermum peltatum*
- Rain Tree – *Samanea saman*
- And MDF



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