AN INTEGRATED INFORMATION SYSTEM FOR SUPPORTING THE PROCESS OF DETERMINATION OF THE TYPOLOGY OF THE FOREST MANAGEMENT UNIT

(An Improvement Process For The Indonesian Sustainable Natural Forest Production Management Certification Process)

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SUPPORTING THE PROCESS OF THE DETERMINATION OF
THE TYPOLOGY OF THE FOREST MANAGEMENT UNIT
(An Improvement Process of The Indonesian Sustainable Natural Forest Production Management Certification Process)

by

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ABSTRACT

The issue of environment became a global issue since 1992 UNCED meeting in Rio Brazil. The Ecolabel product is one of the part of the issue. The Forest certification is one of the alternative develop to answer the ecolabel products. The forest certification aims to evaluate the forest management its activities starting from input, process, and output through a certain series and procedure. The general standard for the forest certification is the sustainable forest management principles (sustainable production function, ecological function and social function). Many initiative parties who develop the forest certification as ecolabel instrument from international and national are appeared. In Indonesia the forest certification is build as national initiative that involves many stakeholders parties. Until now the forest certification instrument in Indonesia has been developed for evaluating the natural forest production management system of the forest management unit. This forest certification system is named The Sustainable Natural Forest Production Management Certification System (SNFPM). When evaluating the natural forest production management system of the forest management unit to minimize the bias of the forest certification decision, the SNFPM certification system consider the ecological and social condition of the forest management unit as the objective situation and applied as a local standard for the acceptable value of the evaluation. The consideration based on the ecological and social condition is called the typology of the forest management unit. The determination of the typology of the forest management unit requires information about ecological and social condition of the forests of the forest management unit. Because of the ecological and social condition brings the information that involve the elements of spatial aspects, therefore the remote sensing and geographic information system may improve the process of the determination of the typology of the forest management unit. The development and partial implementation of the model of the determination process of the typology of the forest management unit indicates that the remote sensing and geographic information system can improve the process of the determination of the typology of the forest management unit by improving the delivery process, information processing and improve the way of visualization the ecological and social condition.

1 Keywords: forest management, sustainable forest management, forest certification, The Natural Forest Production Management System, Forest Management Unit, The Sustainable Natural Forest Production Management Certification System, The Typology of The Forest Management Unit, Ecological Condition, Social Condition, Remote Sensing, Geographic Information System
Dedications

This thesis and my works are dedicated to my parents, my sister and my beloved Siti Isfiati
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TERM AND DEFINITION

Sustainable Forest Management (SFM) is a series of strategies and management of activities of managing the forest resources with the certain objective to reach. The sustainable forest involves the sustainable of forest production function, sustainable of forest ecology and sustainable of social function (Sustainable Forest Management or SFM principles) (Evans 1996)

Forest certification is a an evaluation tool for evaluating the forest management performance of the forest management unit. The essence of the evaluation is auditing process of the process management (input, process and output) of the forest management unit compare to the SFM principles (Evans 1996).

Forest management is the application of business methods and technical forestry principles to the operation of a forest property or forest management unit (Davis and Johnson 1987)

Forest management unit (FMU) is an area of forest that is under a single or common system of forest management. It could be a forest concession, a privately held area of forests land or a series of small area owned by different people, but managed under a common system (Higman, Bass et al. 1999). The forest management unit is a centre of sustainable yield regulation (Simon 1994; Lembaga Ekolabel Indonesia 2000b)

LEI = Lembaga Ekolabel Indonesia Indonesian Ecolabel Institute, an institute that develop the forest certification system in Indonesia

The Sustainable Natural Forest Production Management is an application of business methods and technical forestry principles to the operation of the forest management unit in the natural forests areas which the objectives is the forest production (i.e. woods). The management activities should guarantee the forest function, i.e. sustainable of production function, ecological function and social function. (Lembaga Ekolabel Indonesia 2000b)

The Sustainable Natural Forest Production Management Certification (SNFPM) is the forest certification process for natural forest production management. This consist of series of evaluation activities for The Sustainable Natural Forest Production Management. The series of activities involves and dependent between the client (FMU), expert panel, assessor team, certification body, certification council and other related stakeholders in the the SNFPM certification (Lembaga Ekolabel Indonesia 2000b).

Expert panel is an ad hoc team that formed by the certification body. The members is individuals which every individual is an expert and have a depth knowledge about the essence of the forestry and forest certification. The expert panel have authorized to decide the evaluation process of the forest certification. (Lembaga Ekolabel Indonesia 2000b)

Assessor team is a people who has authorized to conduct field assessment as part of the forest management performance evaluation of the forest certification. The assessor team is independent and does not have direct or indirect relationship with the forest management business. (Lembaga Ekolabel Indonesia 2000b)
**Certification Body** is a body or a firm that authorized by the LEI to conduct the forest certification process. (Lembaga Ekolabel Indonesia 2000b)

**Certification Council** is a council that authorized and given the special mandate by the stakeholders to solve the allegation, complain or objection because of the decision and affirmation of the forest certification process. (Lembaga Ekolabel Indonesia 2000b)

**The typology of the forest management unit** is a knowledge or method to classify the forest management unit according to its vulnerability or security risk. The vulnerability is due to ecological and social condition of the forests area of the forest management unit (Lembaga Ekolabel Indonesia 2000b).

**The ecological condition** is an unique ecological condition of the forest area in the forest management unit that may become a constraint or influence the forest management activities, *e.g.* percentage of steepest slope area, catchments area etc (Lembaga Ekolabel Indonesia 2000b).

**The social condition** is a specific culture and social situation of the local community surrounding or inside the forest management working area that may become a constraint or influence the forest management activities, *e.g.* location of the utilization zone, the production technique, the needs of land etc (Lembaga Ekolabel Indonesia 2000b).
CHAPTER 1.

INTRODUCTION

1.1. Background

Ecolabel or *environmental users friendly products* became a global issue since the 1992 Earth Summit in Rio (the 1992 UNCED meeting). The ecolabel issue is no longer only associated with environment activist, but also with international Communities, Business and Consumers. They may consider this issue as their consideration before buying the products (McIver 1997; Lembaga Ekolabel Indonesia 1999). Nowadays they demand that all the product that come from natural resources it should comes from the sustainable manner (Morrison 1992).

Towards this issues especially for the forest products (woods), the consumers need to convince that the forest products is coming from the sustainable forest management. The Ecolabel certification is one of instrument that can answer this issue. The Ecolabel product will make different from others because the certified (eco-labeled) product is the product that has been proven coming from the sustainable manner. The target of environmental issue is clear, producer are enforced to use the product from the sustainable natural resource area, in other word *through the ecolabel, producers can ensure consumers that the products are come from sustainable manner* (McIver 1997; Lembaga Ekolabel Indonesia 1999).

The ecolabeling instrument in Indonesia was developed as a National Initiative. The development of the ecolabeling instruments involves multi stakeholders parties, and it is initiated by an NGO namely LEI (Indonesian Ecolabel Institute). After 4 years the system development process, the ecolabelling instruments has been developed for instruments to evaluate the natural forest production management system of the forest management unit. This ecolabel instrument is named The Sustainable Natural Forest Production Management (SNFPM) certification system. At present the LEI acts as an institute that developed the system, conduct monitoring for the system implementation and lets the certification body to implement the certification system (Lembaga Ekolabel Indonesia 1999; Lembaga Ekolabel Indonesia 2000a). In 1998 Forest Stewardship council who developed their standard for the forest certification made a Mutual Recognition Agreements with LEI. Starting from that there are two certification standard systems are operational in Indonesia *i.e.* The LEI SNFPM system and FSC system (Agung and Hinrich 2000).

The current development remote sensing and geographic information technology influence many organization and their management system, the benefit from the remote sensing and geographical information system as an Information system is that it supports the organization function more efficient especially for sharing data for the among various user (Bernhardsen 1999). Based on that, the present LEI SNFPM certification system needs improvement, because the remote sensing and geographic
information technology might be useful to improve the information processing of the process of forest certification.
The SNFPM certification will assess the criteria and indicators based on Sustainable Forest Management Principles (Evans 1996). The assessment of criteria and indicator requires verification activity from the input, process and output of the management process. To avoid the bias of the forest certification decision because of the ecological condition and social condition, the SNFPM certification system during the evaluation process defines the typology of the forest management unit. The typology of the forest management unit aims to classify the forest management unit according to its vulnerability or sensitivity of ecological and social regional condition (Lembaga Ekolabel Indonesia 2000b).
The remote sensing and Geographic Information System technology found that it is useful to provide the information about the ecological and social condition of the environment and forest (Sader 1992; Warbring and Levien 1992; Didon 1993; Apan 1997; Grim, Seifert et al. 1999; Roberts, Hall et al. 2000; Tyrie 2000). Because of this remote sensing and geographic information technology is believed can supported the forest certification process. The research will be focused in the study of the present system and how remote sensing and geographic information technology can improve process of the determination of the typology of forest management unit as one of the process of the SNFPM certification.

1.2. Research Problem Formulation

The SNFPM is build on top of existing natural forest management system, because the essence of forest certification is auditing process. Auditing process is verification and confirmation (Evans 1996). The natural forest management system is build to implements sustainable forest management principles (ITTO 2001), therefore the forest management should be able to guarantee the sustainable of production, environment and social function (Stortenbeker, Blom et al. 2001). To improve the verification and confirmation process of the SNFPM certification system, study on both of the natural forest production management system and the SNFPM certification system is one of important aspect in this research. The study aims to develop the model showing the information and its processes involved for understanding the information that will be used for input, process and output in the natural forest production management system compare to the processes in the SNFPM certification.

A part process of the SNFPM certification processes is the determination process of the typology of the forest management unit. The typology of the forest management unit plays an important role especially during the decision-making process in certification (Lembaga Ekolabel Indonesia 2000b). The typology of the forest management unit will be used

- To define objective situation that expert panel (evaluator and decision maker) should understand it as a main reference information for their consideration during decision making process.
- As a basis of reference to define standard acceptable values for every indicator, later the standard values will be compared with the actual value in final decision making process in SNFPM evaluation process.

Therefore typology of the forest management unit is considered as an initial important information. This information should be considered in the evaluation of planning and management process of the forest management unit (Agung and Hinrich 2000). However the LEI Guideline 99 document (Lembaga Ekolabel Indonesia 2000b) only prescribed the guideline, methodology and its standard for defining the typology of
forest management unit. From the LEI guideline 99 documents it indicates that the
information for the determination process of the typology of the forest management
unit are the information about the ecological and social condition. This information
can be found from the documents of the planning process of the forest management
activities (Agung and Hinrich 2000). The information of the ecological and social
condition have an element of spatial information, and because of this, the application
of GIS and Remote sensing may be useful as a tool for improving the typology of
forest management unit assessments process as part of improvements of the
SNFPM certification system. Some literature be can found that the use of geo-
information technology for supporting the automation of process, delivering and
updating of information for users and decision makers to make decisions in managing
natural resources (Austin 1992; Calnan 1992; Warington and Levien 1992; Grim,
Seifert et al. 1999; ESRI 2000; Hussin 2001; Mendoza 2001). The development of the
information system that enables automation process to provide information that
supports the determination process of defining the typology of the forest management
unit is the main focus in this research. This research is part of the process for
improving the sustainable natural forest production management (SNFPM)
certification process.

1.3. Research Objectives

Main objective of this research:
1. Develop the model for the natural forest production management system and
the model for the SNFPM certification system to understand its relationship of
the information flows.
2. Design an information system model for the determination process of the initial
typology of the forest management unit that supports the process of the SNFPM
certification.
3. Explore the potential of remote sensing and geographic information system for
the determination process of defining the typology of the forest management
unit.

1.4. Research Question

1. What are the information needs for the SNFPM certification system that comes
from the natural forest management system, in general?
2. How does SNFPM certification system relates to the natural forest production
management system?
3. How is the determination process of the typology of the forest management unit
implemented in practice in the process of forest certification?
4. Who are the important actors in the SNFPM certification system? What is their
role in the determination process of defining the typology of the forest
management unit?
5. Where are the weak points, which needs improvements of the present
determination process of defining the initial typology of forest management
unit?
6. Can GIS and remote sensing improve the determination process of the typology
of forest management unit?
7. If the answer is yes how does the system look like?
1.5. System Design And Methodology

1.5.1. System Development Methodology

The approach for this research will use system development life cycle (SDLC) or waterfall model. The steps in system development life cycle will shown as follow:

![Diagram of System Development Life Cycle]

The reason using this approach is because the SNFPM certification system considers as the present system that needs improvements. The improvements is needed because of the influence of the information technology and alternative requirements (i.e. remote sensing and geographic information system technology) will have a
benefits and changing the process of the present ongoing processes (Laurini and Thompson 1998; Bernhardsen 1999). This approach has been proven for many years because it focuses on each steps of system development process and it has been tested as mainstream of information system development (Clifton and Sutcliffe 1990; Gangolly 1997; Hawryszkiewycz 1998; Laurini and Thompson 1998; Goncalves and Antunes 2000). It is a ‘traditional approach’ but with some modification in each step with different approach methods that makes System Development Life Cycle approach useful especially for re-engineering existing system (Clifton and Sutcliffe 1990; Paresi 2000).

1.5.2. System Analysis

Understanding about how the present system works is important in this step (Clifton and Sutcliffe 1990; Paresi 2000) at this stage the soft system approach will be used to understand and structured the system in term of data flow diagram. Because "typology of the forest management unit" is part of the process in the SNFPM certification system therefore using soft system analysis to understand what is typology of the forest management unit then it is important to understand the SNFPM certification system. After that next, a model of SNFPM certification system will be developed. However because the development of the SNFPM certification system is based on existing natural forest production management system therefore the it is important also to understand what is the natural forest production management system, how it relate with the SNFPM certification system (This part will become the answer of question no 1 to 4). Then part of the SNFPM certification model there is a process model for the assessment of typology of the forest management unit. This research will concentrate on this process. To improve this process, the study more further detail about the information requirements for the assessment of typology of the forest management unit will be conducted. Next activity is the process of assessment of initial typology of the forest management unit will be breaking down into more further detail processes to model the flow of information and identify which process that needs improvements.

1.5.3. System Design

After development of the model for assessment of typology of the forest management unit, next, based on the model then the information system specification can be defined based on information requirements. The model for the assessment of typology of the forest management unit also can be used to develop the data model by identify the information flows. The data model will be developed with help of CASE tools software (VISIO 2000 SR-1). The Data model approach will use the relational model because this model was easy to implements in the DBMS software and currently in the markets most of the DBMS software are using the relational model. The selection of system architecture is also include in this step as part of the process development of software and hardware selection that supports the user requirements (Clifton and Sutcliffe 1990; Hawryszkiewycz 1998; Paresi 2000).

1.5.4. System Implementation and Testing

After the data model for the assessment of typology of the forest management unit has been verified using CASE tools software, next is converting the data model into selected DBMS and RS/GIS software then start producing the information that supports the process of assessment of typology of the forest management unit (this will answer question no. 6). Ideally using the Information technology then process of
the current system be efficient and improve (in relation with the products) (Clifton and Sutcliffe 1990; Hawryszkiewycz 1998; Paresi 2000) while the old process needs a hard work and a lot of time for assessment process of typology of the forest management unit (this will answer question no 7).

1.6. Selected Case Study Area

The implemented natural forest production management system in the forest management unit is a pilot study for testing the assessment model of typology of the forest management unit as part of the SNFPM certification process. This research will use the Labanan forest management unit of Inhutani I as the study of the natural forest production management model and pilot study to test and implement the improvements of SNFPM certification process. The area is located in Berau District Regency, Northwestern East Kalimantan province, Indonesia (BFMP 1999). The boundaries of the study area are between latitude 2° 10’ N and 1° 45’ N and longitude 116° 55’ E and 117° 20’ E. The management unit is owned by government as a part of government business unit in forestry (INHUTANI I). This concession is a joint cooperation with European Union with Inhutani I as government representative to develop sustainable production forest management model, the project is called "Berau Forest Management Project" and Labanan is the forest management unit for developing and implementing of forest management model (BFMP 1999).
1.7. Structure of Thesis

The Structure of thesis will be:
Chapter one. Introduction
This Chapter explains the background, problem formulation, research objective, some question, methodology and selected area for case study
Chapter two. The Natural Forest Production Management and Forest Certification System
Because the SNFPM certification system is build on top of the existing natural forest production management system therefore using soft system approach, the system analysis will analyze both of the natural forest production management system and the SNFPM certification system. This chapter shows the process about development of The Natural Forest Management Model. Second part of this chapter discuss about the aspect of forest certification and SNFPM certification system then the model is developed of the information flow of SNFPM Certification Model and how it relates with Natural Forest Production Management. Furthermore as part of the SNFPM certification model, a process for assessment of typology of the forest management unit will be described more detail in chapter three.
Chapter three. The Determination of The Typology of The Forest Management Unit
This Chapter will discuss the information needs of the present determination process of the typology of the forest management unit. The second part will discuss the development of the model for the determination process of the initial typology of the forest management unit, the descriptions and its suggestion for process improvements.
Chapter four. The Design of the Information System Design for the Determination process of the initial typology of the forest management unit
This Chapter shows the design of the information system based on model for the determination of the initial typology of the forest management unit. The design elements includes the development of the data model which is part of the development of the information system. The data model is developed based on the information flows in the diagram model for the determination of the typology of the forest management unit
Chapter five. The Partial Implementation of The Information System for The Determination Process of The Initial Typology of The Forest Management Unit.
This Chapter shows the model implementation using RS and GIS software. The chapter will show the application using RS/GIS to support the determination process of the initial typology of the forest management unit. Some sample products will be shown here as a testing part to show the information that supports the determination process of the initial typology of the forest management unit.
Chapter six. Discussion and Conclusion
This Chapter discuss aspects about whole process that have been done in the theoretical and practical approaches. Finally then the conclusion is made based on the discussion.
CHAPTER 2.

THE NATURAL FOREST PRODUCTION MANAGEMENT AND FOREST CERTIFICATION

2.1. Introduction

In the first part this chapter shows the development process of The Natural Forest Management Model. This model is developed because the Forest Certification is developed based on the existing forest management model and the essence of certification is an auditing process which is mainly verification and confirmation process, therefore it is important to understand the current natural forest production management process before understanding the forest certification. Second part of this chapter, a model is developed of the information flow of the SNFPM Certification process and its relation with the natural forest Production management system.

2.1. The Natural Forest Production Management Model

Because of wide-ranging variation of the natural forest production management system for the tropical rain forest management, there can be no single approach or method for implementation of sustainable forest management in tropical forests where wood production is the main objective (FAO 1995). But the important part for this study is understanding the information products (input, process and output) that are coming from every activity of the forest management, therefore the model of The Natural Forest Production Management system was developed to understand the information flow. This information will be used as input information for the SNFPM certification process.

The Model is developed using soft system analysis which requires literature study to understand the forest management system of tropical rain forest in Indonesia (Simon 1992; Simon 1994; FAO 1995; Agung and Hinrich 2000; Anonymous 2000) and functional analysis of the organization structure of that in very common are appears in every forest management unit which is the main objective is wood production in tropical rain forest area (see Appendix 4-8).
Figure 2.1-1. The Natural Forest Production Management Information Model. The Context Diagram based on forest certification point of views.

source: interview (see appendix 4-8) and (Lembaga Ekolabel Indonesia 2000b)

Note:
For Simplification purpose, the information flows that coming out from the natural forest production management system has been simplified as shown in figure 2.1-1. Although the real information needs for the SNFPM certification systems are a lot (see appendix 10 and (Lembaga Ekolabel Indonesia 2000c)). Some of the processes in business activities and technical forest operation includes the silviculture of the forest management unit activities, will be represented by a single process (and it will not shown in the lower level diagram model), but it will be provide on the detail explanation of figure 2.1-2

The detailed process of this model is provided in the next diagram.
The process indicated in figure 2.1-2. will be described in detail following paragraphs.

General System Description of Figure 2.1-2.
The Natural Forest Management Information model in general has at least six major activities (Agung and Hinrich 2000; Anonymous 2000; Lembaga Ekolabel Indonesia 2000b), i.e.

Process name: 1. Data Management and Documentation

Objective:
Collecting, receiving updated data within a data management system that supports unit management activity (see appendix 7).
**Function:**
Central Data for Information base management

**Input:**
Remote Sensing Data (source: interviews)

<table>
<thead>
<tr>
<th>Data Name</th>
<th>Data Type</th>
<th>Frequency update</th>
<th>Original Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite Images</td>
<td>Image</td>
<td>2 years once per 20 years planning period</td>
<td>RS Agency / FMU</td>
</tr>
<tr>
<td>Aerial Photo</td>
<td>Image</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Basic Spatial Data (source: interviews)**

<table>
<thead>
<tr>
<th>Data Name</th>
<th>Data Type</th>
<th>Frequency update</th>
<th>Original Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topographic Spatial Land Use (RTRWP+TGHK)</td>
<td>Spatial data</td>
<td>depend on</td>
<td>Government</td>
</tr>
<tr>
<td>Climate Administration and Government Hydrology</td>
<td></td>
<td>monthly depend on Government</td>
<td>Local Station Government</td>
</tr>
<tr>
<td>Soil+ Geology+ Vegetation Land System*</td>
<td></td>
<td>2 years</td>
<td>Water/ForestDept Agriculture Dept Geology Dept RS Data Update Repprot</td>
</tr>
</tbody>
</table>

*alternative option if + not available

**Socio-Economic Data (source: interviews)**

<table>
<thead>
<tr>
<th>Data Name</th>
<th>Data Type</th>
<th>Frequency update</th>
<th>Original Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village in Statistics</td>
<td>Non spatial data</td>
<td>Depend on Local Government</td>
<td>Local Government</td>
</tr>
</tbody>
</table>

**Output is**

<table>
<thead>
<tr>
<th>Data/Information Name</th>
<th>Data Type</th>
<th>Frequency update</th>
<th>Original Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Spatial FMU and RS Data for planning, Forest Survey data, forest management routine data, social management data, environment management data, other document as required</td>
<td>Spatial data and non spatial data</td>
<td>Auto update as activities of unit management occur</td>
<td>NMA, Forestry Dept, Soil Dept, Meteorology Service, Forest Service, Local Government, Statistics Office, etc.</td>
</tr>
</tbody>
</table>
Process name: 2. Forest Management Planning Activity

Objective:
To make the forest management plan that implements Sustainable Forest Management Principles which the objective of planning is wood production (Government Regulation No. 21 & 33/1970 about Forestry Planning; Ministry of Forestry regulation No. 732/Kpts-II/1998, No 273/Kpts-II/1999, No. 310/Kpts-II/1999)

Function: (refers to appendix 4-8)
As functional activity that make plan before starts to run the business activity and applied technical forestry principles to the operation of forest management unit

Input:

<table>
<thead>
<tr>
<th>Information Name</th>
<th>Data type</th>
<th>Frequency</th>
<th>Detail level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic data for forest planning</td>
<td>Spatial data and non spatial data</td>
<td>According to the planning periods and planning level</td>
<td>General to Detail</td>
</tr>
</tbody>
</table>

An integrated part in forest management plan are (Simon 1992; Anonymous 2000)

1. Area Delineation and Boundary Establishment
This process is an important because establishing forest management unit needs fixed and clear boundary area of the forest area. During the process, the survey team will establish the physical boundary marks in the fields and measure the position and record it in the register form. The area delineation process should involved local community, they should participate and an approved the FMU boundary. The Government will give an approval after this process was finished and by this government approval the boundary of forest management unit is legal (Ministry of Forestry regulation No. 900/Kpts-II/1999).

2. Forest Management Planning
Forest management plan usually have a planning period because of wide area and application technical forestry principles (e.g. silviculture, nursery etc.), this kind of activity needs to manage within time rotation activity (FAO 1995). The planning is divided into two major planning categories based on objective of planning:
   a. Planning for managing forest area where wood production is the main objective.
   b. Planning for environment management and monitoring where to monitor and minimize the environment effect due to forest management unit is the main objective.

a. Planning for managing the forest area which wood production is the main objective
Forest Planning In Indonesia has three planning periods (Indonesian Forestry Handbook, 1997) i.e. 20 Years Planning (RKPH) or Long term plan, 5 Years Planning (RKL) or Medium Planning and 1 Years Planning (RKT) or Annual Plan. The relation between elements of Long-term plan, Medium Plan and Annual Plan management planning cycle are shown in Table 2.1.1.
Table 2.1-1. The Forest Management Planning Life Cycle

<table>
<thead>
<tr>
<th>Management Level</th>
<th>Time Frame</th>
<th>Key Elements of Forest Management</th>
</tr>
</thead>
</table>
| Strategic        | 20 years   | Global Forest Inventory (1% of sampling intensity)  
|                  |            | Global forest management function, strategies and policies  
|                  |            | Yield Regulation Strategy |
| Operational      | 5 Years    | Semi-Detail of Forest Inventory (5% of sampling intensity)  
| Issues           |            | Management Function  
|                  |            | Institutional function  
|                  |            | Social approach  
|                  |            | Technology approach |
| Operational      | Annual     | Detail of Forest Inventory (100% of sampling intensity) incl. Tree location (tree mapping)  
| Issues           |            | Implementation-function  
|                  |            | Implementation-technology |

Adopted from: (FAO 1995)

Beside the FMU Basic data as an input, within the forest planning activity the forest inventory is conducted to get detailed information about forest characteristics (Simon 1993; Ministry of Forestry 1997; Anonymous 2000). The detail information level about forest characteristics is depending on the objective of forest survey which refers to the planning period/forest planning level (Simon 1993). Furthermore the level of information need is based on forest survey is shown in table 2.1.2.

Table 2.1-2. Level of Information needs of The Forest Survey Inventory and Planning periods

<table>
<thead>
<tr>
<th>Forest Survey Inventory Where the objective is wood production</th>
<th>Detail level of Information</th>
<th>Planning Period</th>
<th>Time</th>
</tr>
</thead>
</table>
| forest Survey with max 1% of sampling intensity                 | general                     | 20 Years        | Every 20 years with interval 10 years for repeated survey (option) (GTZ,2000)  
| forest survey with max 5% of sampling intensity                 | Semi detail                 | 5 Years         | Every 5 years  
| forest survey with 100% of sampling intensity                   | Detail with map scale up to 1:1000, and produce tree maps | 1 Years         | Every years which is two years before cutting activity if refers to TPTI silviculture system (Indonesian Forestry Handbook, 1997)  

Hence (SFM-GTZ) prescribed that within long term planning activity (strategic level) at least six important steps should be considered:

- Land Use Planning (zoning) to define net use able area for production: the criteria for defining net use able area for production area is shown in figure 2.1-3.

![Diagram of forest area management procedure](image)

**Figure 2.1-3. Flowchart Diagram Procedure For Defining Net Useable Area in Forest Production (SFM-GTZ; Anonymous 2000)**

- Orientation Survey for the whole area: the survey is based on field survey which use systematic line plot method with low sampling intensity (not more than 1%) or 500 – 700 sampling plot systematically in the whole area.
- Develop the Local Growth Model based on regular updated forest stand inventory by establishment permanent sampling plot.
- Define Annual Allowable Cut (AAC)
- Planning for production by defining cutting block for 10 years projection plan. The priority cutting areas are based on potency volume of standing stock in certain cutting blocks area and depend on criteria defined by management unit.
- The survey orientation will repeat every 10 years for AAC revision for next planning activity and for anticipation of unexpected or unpredictable environment change.

Theoretically since the forest area is divided according to a 35 years rotation system. The planning period should be covering a 35 year forest management plan (Indonesian Forestry Handbook, 1997). But the government decided that the planning period is only 20 years for simplification purposes (FAO 1995). When the planning after 20 years has been evaluated and the forest management unit has proven that they can manage the forest production as prescribed then they can continue to make another forest planning activity for another 20 years (Forestry Regulation no 5/1967). But this 20 years period for the forest management unit (concession company) point of view is considered as a short period so in practice so many forest management units use this 20 years opportunity to cut all of the
compartment group of 35 years rotation because they are a company that should make a profit (Priyageng 1997)

b. Planning for environment management and monitoring where to monitor and minimize the environment effect due to forest management unit is the main objective

Every activity that will have impacts to the environment should have a Environment Impact Analysis (EIA) report followed by plan to minimize the effect (Government regulation No 27/1999). Therefore EIA is an integrated part of the forest management Planning activity. Based on EIA report a plan is designed for minimizing the environment effect (RPL). The RPL is formulated after 5 years forest management plan is designed and will be verified by the government (Ministry of Environment) (Kepala Bapedal/Environment Controlling Agency Regulation No 9/2000).

Output : Planning Documents
The output are consists of two planning documents, i.e. planning document for forest management and planning document for environmental management.

1. The planning document for forest management:
   - Field Boundary Establishment report, in general it contains information geographic location of boundary marker in the field. Every point taken by surveying tools, people/stakeholders who are involved in the boundary establishment process, government approval (“Laporan Tata Batas” of Labanan FMU of Inhutani I and Ministry of Forestry regulation No. 333/Kpts-II/1999)
   - 20 Years Forest Management Plan (RKPH), contains global information about (Ministry of Forestry regulation No. 314/Kpts-II/1999 and (Lembaga Ekolabel Indonesia 2000c); see appendix 10)
     a. Company description
     b. Basic data about forest area and forest management unit
     c. Framework about forest management based on basic data and the assumption used
     d. Scenario plan for forest management for 20 years management activity
     e. Forest management organization for the implementation plan
     f. Feasibility Analysis for projected plan (20 years). The feasibility analysis is essential and it’s obligated for the forest management unit when submit the permit to get production/logging operation license from government because it will analyse whether it is feasible or not (financially and economically) for the forest production area as the forest management unit (Ministry of Forestry Regulation No. 312/Kpts-II/1999).
     g. Attached file: interpretation of remote sensing data, basic spatial data and forest inventory result (hardcopy)
   - 5 Years Forest Management Plan (RKL), besides contains general information like 20 years management plan (RKPH), it also contains global information about Plan for area preparation, opening up the forest area, enrichment planting, tending, logging and marketing, forest protection, infrastructure, organization, personal, training and education, social activities (Ministry of Forestry regulation No. 314/Kpts-II/1999 and (Lembaga Ekolabel Indonesia 2000c)).
   - 1 Years Forest Management Plan (Annual Plan/RKT), contains detailed information about Plan for area preparation, opening up forest area,
enrichment planting, tending, logging and marketing, forest protection, infrastructure, organization, personal, training and education, social activities. Includes also as attachments forest tree maps and opening-up forest area plan (road network plan) (Ministry of Forestry regulation No. 314/Kpts-II/1999 and (Lembaga Ekolabel Indonesia 2000c)).

- Operational Plan (Standard Operating Procedure), is the detail technical requirements for the operational of annual plan (see appendix 6 and (Lembaga Ekolabel Indonesia 2000c))
- Recapitulation of forest inventory report (LHC) here consider as an important report that will be use as data for verification for the forest certification, includes also tree position (tree maps) for all tree species (Lembaga Ekolabel Indonesia 2000c).

2. The output for environmental planning documents:

- Environment Impact Assessment, explain global information about predictive impact due to certain forest management activity which it refers to the 20 years forest management plan and recommendation for decision maker for making detailed plans to minimize the environment impact (Kepala Bapedal/ Head of Environment Controlling Agency Regulation No 9/2000)
- Environment Monitoring and Management Plan (RPL), contains a plan for the environmental monitoring and environment management because of the forest management practices and its activity that cause the negative impacts for the environment, include a technology approach, institutional approach, and social approach. But this document only explains the global information while the detail information should be implemented in annual plan for environment monitoring and management (Kepala Bapedal/ Head of Environment Controlling Agency Regulation No 9/2000)

Process name: 3. Forest Management Plan Implementation

Objective:
To implements the silviculture system and extracts the wood from the forest area into logs according to the annual plan (RKT) to gain the benefit from selling the woods/logs (FAO 1995; Ministry of Forestry 1997)

Function: (refers to appendix 4-8)
Implementation Forest Management process

Input:
Forest Management Plan (and Operational Plan) includes Forest Survey report, tree maps and topographic maps (scale up to 1: 2000) (Ministry of Forestry 1997; Anonymous 2000)

Some silviculture based on TPTI activities are (Indonesian Forestry Handbook, 1997)
Opening-up forest area (PWH) 1 years before Logging operation include establishment of the infrastructure support e.g. camp, forest ranger check point etc.
- Logging activities, include logs administration and transportation (administration system for logs). The logging is based on tree maps which it shows position and tree number. The tree are marked differently (protected tree, cut tree, and mother tree), Only the trees that are marked with “allowed to cut” will be cut/harvest (commercial tree).
- Liberation, 1 Years after logging operation (Et+1)
Inventory of Residual Stand (post harvesting inventory), 1 years after logging include area re-arrangements for enrichment (Et+1)
- Procurement planting stock, 2 years after logging (Et+2)
- Enrichment Planting, 2 years after logging (Et+2)
- First Stage Tending, 3 years after logging (Et+3)
- Advanced Tending:
  - Liberation, 4 years after logging (Et+4)
  - Tending, 9 years after logging (Et+9)
- Forest Protection and Research, including establishment of permanent inventory plot for research and development (continuation)

**Output:** Forest Management Implementation reports (refers to appendix 10)
The detail documents about forest management implementation reports are
- Recapitulation of production report (LHP)
- Recapitulation of Logs transportation / logs administration reports (LMKB), This information contains a set of documents of every tree that has been cut from cutting block until log pond, so the tree with this system can be traced. So for chain of custody this report is very useful information (LEI Guideline 99).
- PIP (Permanent Inventory Plot) measurement report, it contains monitoring data for establishing local growth model of natural forest. The purpose of establishing this plot is to reduce or minimize forest survey inventory activities especially for the long term planning activity. So in the future if the growth model has been verified. It is no longer necessary to conduct forest survey inventory especially for long term planning (Ministry of Forestry 1997; Anonymous 2000)
- Post Harvesting Inventory report, it contains report about the activities of area re-arrangements for planting purposes, impact forest condition after logging activity, seedling, sapling, poles, trees, mother trees. Every tree that consider as commercial tree will be recommend to keep growth and treated as a potential tree while others will not have a treatment (Ministry of Forestry 1997; Anonymous 2000)
- Post production report. It is a sets of documents that contains silviculture activities and silviculture treatments after the production. Some silviculture activities are (Ministry of Forestry 1997; Anonymous 2000); refers to appendix 10
  a. Liberation report
  b. Procurement planting report
  c. Enrichment planting report
  d. Evaluation on enrichment planting report
  e. Tending report
  f. Evaluation on enrichment planting report

**Process name: 4. Environment Management Plan Implementation**

**Objective:**
To Monitor, control and anticipate (management) the environment impact due to forest management activity. (FAO 1995; Ministry of Forestry 1997)

**Function:**
Early environment management activities.
Input:
Environment Management plan

Output:
Environment management Implementation report, this documents are (refers to appendix 11; (Lembaga Ekolabel Indonesia 2000c)):
- Environment Management report (RPL-a)
- Environment Monitoring Report (RPL-b)

Process name: 5. Social Management Plan Implementation

Objective
The forest management unit should have a contribution to the community development especially to support the development of the forest community surrounding the forest management unit. Therefore the Forest Management Planning should include planning for supporting forest community development ((Simon 1992); Ministry of Forestry Regulation No. 622/Kpts-II/95).

Function:
As a participation of forest management unit that supports the local government development program ((Simon 1992); Ministry of Forestry Regulation No. 622/Kpts-II/95)

Input:
Social Management Plan

Output:
There are no fixed output from this activity but the output may be (refer to appendix 10; (Lembaga Ekolabel Indonesia 2000c))
- Social Management Report, which contains information about the activity of community development and its impact for the community.
- report of social development participation
- Other social activities reports

Process: 6. Accounting and Finance

Objective:
To manage and support financially of the forest management activity (see appendix 6).

Function:
Financial and accounting supports for business activities

Input:
Forest Management Financial Plan

Output: (refers to appendix 10)
Financial Report of all forest management, environment and social activities, this document will be used as verification for the indicators level in SNFPM certification system (Lembaga Ekolabel Indonesia 2000b; Lembaga Ekolabel Indonesia 2000c)
Process: 7. Personal and Administration

Objective:
To support the personal / forester for the all organization activity (see appendix 6).

Function:
Personal and administration that supports organization and management activity

Input:
Forest Management personal requirements

Output: (refers to appendix 10)
FMU personal data, it contains information about all the personal/forester in FMU and their technical abilities, expertise, gender, etc. (Lembaga Ekolabel Indonesia 2000b; Lembaga Ekolabel Indonesia 2000c)

Process: 8. Auditing and Monitoring

Objective:
To conducting monitoring and evaluation of the planning implementation, organization and activity (see appendix 6).

Function:
Monitoring and Evaluation process

Input:
All Planning documents, all planning implementation reports

Output: (refer to appendix 10)
Auditing report of Forest Management Planning Implementation, it contains information about the auditing report of forest management planning implementation, e.g. Auditing report of Silviculture activity, Auditing report of Environment Management Plan etc. (Lembaga Ekolabel Indonesia 2000b; Lembaga Ekolabel Indonesia 2000c).

2.2. The Sustainable Natural Forest Production Management Certification System Model (SNFPM)

2.2.1. The Framework of The Sustainable Natural Forest Production Management Certification System

The Sustainable Natural Forest Production Management certification model is developed based on the existing forest management system because the idea of certification is to evaluate the forest management performance and its management implementation (input-process-output) (Evans 1996). The forest certification system is designed as an auditing process by verifying and confirmation the information from the forest management unit instead collecting a new data from the field (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).

Key players in the SNFPM certification are assessor team, expert panel, The Indonesian Ecolabel Institute (LEI) and Forest Management Unit (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).
The Assessor team is a third party trusted Institution (certified) who is given the mandate by LEI to do field assessments (design field data collection, analyze and verify) using criteria and indicators as prescribed by Indonesian Ecolabel Institute and make a report and confirm to the expert panel (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b)

The Expert panel are individuals with an in-depth knowledge of the condition of the assessed concession area or knowledge to the forest function. Based on this definition expert panel members may represent various parties, direct or indirectly involved with the forest and forestry in general. The LEI SNFPM system has set up the procedures to appoint expert panel members through local / district forum committee. This committee will recommend who are the expert panel members for a certain forest management unit evaluation. There are two expert panel teams with different roles: to assess documents of FMU being evaluated (expert panel I) and to make a decision and give recommendations of the certification level (expert panel II) based on field assessor report (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).

Indonesian Ecolabel Institute (LEI) is an institution who designed and implemented the forest certification system in Indonesia. This institution is given the accreditation of the third party inspector (assessor) and always conduct the monitoring and evaluation on the forest certification system implementation (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).

Forest Management Unit (FMU) is a main client who applied for certification on the voluntary basis. The FMU is responsible to provide the documents and information transparently and all document and information will be kept confidentially. Only the expert panel, the assessor and the LEI have right to access for the documents and information (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).
In evaluating the forest management of a concession unit, the Indonesian SNFPM scheme is based on two components (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b):

- The components that characterize the outcome of forest management unit (SFM Principles Dimension) (see the LEI document standard 5000-1)
- The components that describe the strategies to attain sustainable forest management (Management Dimension) (see the LEI document standard 5000-1)

The Decision of the certification idea is how far the strategies are implemented in the management unit in the direction of or fulfilling the goal of sustainable forest management. The evaluation is measured through a series objectively verifiable indicators. Criteria and indicators are essentially the components of cross-section between SFM principles Dimension and Management Dimension (see the LEI document standard 5000-1, Appendix 2). Each Indicator is formulated from each explained strategy in effort to fulfill each SFM principles (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).

The Decision-making process utilizes transparent and democratic decision making methodology known as the Analytic Hierarchy Process (AHP) (Lembaga Ekolabel Indonesia 1995; Saaty 2001) because it accommodates different opinion of the expert
panel members (the decision makers) (see more detail in the LEI document 99-24). This methods provides individual or groups with the assistance to deal with inherent multi-criteria based decisions (Lembaga Ekolabel Indonesia 1995; Saaty 2001). The AHP accommodates varied weighting from strategy and criteria in hierarchical structure (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b). The outcome of AHP process in forest certification are threefold (Salim, Djalins et al. 1993):

- Actual proportion value that describes the proportion value of production sustainability, ecosystem sustainability and social sustainability function achieved by management unit, a proportion value which resulted from the strategy
- Ideal/cut-off point proportion outcome for each process of the forest management unit which shows ideal proportion of SFM principles, and which will be the cut-off points for the actual condition
- Concrete ratio between ideal and actual of each aspect to give a composite value with regards to achievement and failures of an evaluated management unit with regards to SFM principles. The ration is used as reference to certification level (grade) for the management unit and to provide guidelines for management unit for improving their management practices.

The Unique characteristics of the forest certification in Indonesia scheme that makes different from the others forest certification system i.e. (Salim, Djalins et al. 1993)

- It separates field assessor and decision makers for certifications to ensure that the forest certification process is free from conflicts interest and from standard degradation.
- It provides complete level for indicator assessments (the data and information needs are explained clearly in (Lembaga Ekolabel Indonesia 2000c) and use a unique standard for indicators assessments, i.e. every indicators has different standard (Lembaga Ekolabel Indonesia 2000d).
- It applied local and dynamic standard which depends on the situation or condition of forest management unit. The dynamic standard is defined according to the classification of vulnerability or its security risk of the forest management unit. The vulnerability of the forest management unit is influenced by the ecological factors and social condition (typology of the forest management unit). The typology of the forest management unit will become reference when the decision maker make a standard acceptable value to compare with the actual value based on field verification (in AHP process). It is dynamic because the typology of forest management unit may be changed due to ecological and social condition. Mostly the changing is caused by the social condition which is also a dynamic situation (Lembaga Ekolabel Indonesia 1995). This factors are considered as a critical factor that influence the forest management planning and its activities.

2.2.2. The Typology and the Standard for Certification System

The standard of evaluation is the criteria by which something is being compared so whenever the judgments is made there must be a standard for comparison (Joint Committee on Standards for Educational Evaluation 1994; Landauer and Rowlands 2001). The logic of the use of standard can be associated in educational domain, the analog is “What is the minimum acceptable value that should be given to the students to denote pass the exam who have a specific condition or typical condition e.g. age, class level, level of the program study” (Setyarso 2000a). The Forest Certification Advisory Group (FCAG) of The European Forest Institute explain that “the heart of most arguments concerning certification standards are: (Bass, 2000)
In the SNFPM certification system, the standard is developed according to the scientific context and agreements of the stakeholders during the meeting process since 1994 stakeholders meeting (Lembaga Ekolabel Indonesia 1995). One of the sets of the standard is the typology of the forest management unit. The typology of forest management unit consider as a unique reference because it has to understand the ecological and social situation. The stakeholders developed the knowledge method to understand the condition of the forest management unit based on the ecological and social condition. Using this method the forest management unit will be classify according to its vulnerability or sensitivity based on ecological and social condition. This method is applied in the SNFPM certification system to minimize the bias of the forest certification decision. During the decision making process of the forest certification, typology of forest management unit will be used as reference to understand the objective situation and a reference to define standard acceptable value for every indicators to compared with actual value of indicator (based on field verification) (Lembaga Ekolabel Indonesia 2000b). Therefore the evaluation will be fair because the standard will be set based on the local forest condition of the forest management unit. The minimum standard acceptable value of the certain evaluation of each forest management unit will be different based on its forest ecological and social condition. This method made the performance of the forest management unit when implementing forest management practice to achieve the sustainable forest management objective is comparable and transparent (Lembaga Ekolabel Indonesia 2000b). The typology of the forest management unit will be elaborated more further detail in chapter three.

2.2.3. The Sustainable Natural Forest Production Management Certification Model (SNFPM)

The Development of the SNFPM certification model requires to do a literature study on various the documents concerning the LEI SNFPM certification system. This information model shows the information flow including the processes involved. The model developed here is based on the LEI Academic Document, LEI Document Standard 5000, LEI Guideline 99 Documents, and interviews for confirmation with the LEI persons. The models are indicated in figure 2.2-2 and figure 2.2-3.
source: Adopted from LEI Guideline 99

Note:
For simplification purpose, the information out-flow from the natural forest production management model that has been shown in figure 2.1-1, has been simplified and it categorized into three kind of information flows, i.e. Forestry documents to represents various documents (planning, environment, auditing etc.) and spatial data to represent spatial data (maps) and remote sensing data (images). although LEI Guideline 99 documents classify the last two categories (spatial and remote sensing data) as part of forestry documents, because spatial data and remote sensing data are part of the forest management plan documents (see appendix 10). However because the main objective of the model development is to understand the SNFPM certification process and to improve the assessments process of typology of forest management unit as part for improving the SNFPM certification process using remote sensing and GIS, therefore the spatial and remote sensing data are separated from the attachments of the documents, and become an essential information for input for in SNFPM certification model.

The detail process of this diagram is provided in the figure 2.2-3.
Figure 2.2-3. Top Level Diagram of The Sustainable Natural Forest Production Management (SNFPM) Certification Information Model

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Gane-Sarson Data Flow Diagram

Source: Adopted from LEI Guideline 99

Note:
The box with discontinued line is refer to figure 2.2-1.

The SNFPM evaluation comprises mainly four major phases (refer to figure 2.2-1.) which is consist of series of process/activity (LEI Guideline 99), there are
1. Pre Field Assessments (Scoping process)
Pre field assessments (scoping process) is a series activities aims to improve the efficiency of the assessments process, \( i.e. \) it is necessary in order for the next evaluation stage, the evaluation will be effective because understanding the information of the forest management unit is fundamental of the evaluation and the forest management unit that does not meet the general criteria will no longer necessary to follow next certification process (Lembaga Ekolabel Indonesia 2000b).

**Actors : Expert Panel I**

There are three processes in this stage, \( i.e. \)

**Process name: 1. Information analysis and determination of Initial typology of the forest management unit**
The detail of this process will elaborated further in chapter 3 to explain the concept and its process assessment of defining typology of the forest management unit and to model its assessment process.

**Objective:**
To evaluate the document validity based on the technical document guideline that are used as reference for the forest management system (Lembaga Ekolabel Indonesia 2000b)
To analyze basic forestry document on the report to see the effort of the forest management unit to implement sustainable forest management (LEI Guideline 99; Setyarso, 2000).
Define the Objective situation and typical condition of the forest management unit. The expert panel is use it for further analysis of the basic forestry document and basic data. The Objective situation is defined based on typology of the forest management unit (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

**Function**
Data analysis, data management and Initial starting activity to understand the typical condition of the forest management unit (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

**Input:** (see figure 2.1-1., figure 2.2-1. and figure 2.2-2., refers to appendix 11)
The sets of standard (Norm) for the evaluation of the SNFPM certification system includes the standard for determining typology of forest management unit (Lembaga Ekolabel Indonesia 2000b)
Information about FMU which can be acquired from
- Forest Planning Documents, \( e.g. \)
  - Boundary establishment report, includes the legal letters, measurement report of boundary marks position etc.
  - Forest management plan: 20 years forest management plan, 5 years management plan, 1 years management plan includes remote sensing data interpretation, basic spatial data, recapitulation of forest inventory report (LHC), Tree maps location. The Social management plan is an integral part of 20 years, 5 years and 1 years management plan
  - Environment management plan, includes Environment Impact Analysis report (EIA), Environment management and monitoring plan (RPL-a for 5 years and RPL-b for 1 years).
- Operational plan (Standard Operation Procedure)
Forest management implementation report
- Recapitulation of production report (LHP)
- Recapitulation of log transportation (LMKB)
- Technical forestry operation and Silviculture activities reports, *i.e.* opening-up forest report, road development report, liberation report, Inventory of residual stand (post harvesting inventory), procurement planting stock report, enrichment planting report, tending report, Permanent Inventory (PIP) report.

Environment management implementation report
- Environment management implementation report (RPL-a)
- Environment monitoring implementation report (RPL-b)

Social management report
- Social management implementation report
- Report proven of social development participation
- Social conflict report
- Social activities report

Personal data of business forest management unit organization

Auditing and Monitoring of forest management plan reports, *e.g.* Technical forest operation auditing reports, silviculture auditing reports, environment implementation auditing report etc.

Financial and Accounting report, *e.g.* marketing reports, financial reports, tax reports etc.

Other document as required or document that relevant and supporting the FMU performance. Beside all data and document listed, the FMU is obligated to provide additional information as information is needed by expert panel.

**Output:**
Information (Data analysis results) usually contains information to confirm with the FMU in the field visit except it is stated that field visit is not required (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

**Process name:** 2. Confirmation and Field Scoping

**Objective:**
To confirm and verify the information. The expert panel feels it requires a clarification from the forest management unit (LEI Guideline 99; Setyarso, 2000)

**Function:**
As a process of verification and confirmation for the expert panel to understand the information from FMU (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

**Input:**
Information analysis based on basic forestry document and basic data of FMU (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

**Output:**
Information that has been confirmed and its reliable to use as main source of information. Some information may be corrected after clarification or may be still remain the same (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)
Process name: 3. Decision making and Recommendation

Objective:
To make a decision whether the FMU has made an effort to implementation of sustainable forest management principle and how far the implementation (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)
To make recommendation for the next phase evaluation (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

Function:
Verifying the forest management practice and see the effort of the FMU to implement SFM based on existing information (basic forestry document and basic data) (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

Input:
Standard for Decision making and recommendation (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)
The information from output from process no 2. (Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

Output:
The Output is a recommendation report that consists of the report about typology of FMU, the consideration, decision and recommendation for assessor to conduct field assessments activities. And the decision and recommendation for the FMU [(Mutu Agung Lestari Ltd 2000; Setyarso 2000a; Lembaga Ekolabel Indonesia 2000b)

2. Field Assessments and Public Announcements

Actors: Assessor team and Public Community
There are two processes in this stage, i.e.

Process name: 4. Field Assessments and Public Announcements

Objective:
To design the field data collection method based on recommendation prescribed by Expert Panel I (Lembaga Ekolabel Indonesia 2000b)
To verify the forest management plan and its implementation based on the actual field condition (Lembaga Ekolabel Indonesia 2000b)
To declare in public that the evaluation process are now open for public, so public can give the input (Lembaga Ekolabel Indonesia 2000b)

Function:
Field data collection and assessments (Lembaga Ekolabel Indonesia 2000b)
Input from the community is a public control, if there are some input from community (allegation, objection etc.) that consider will have an impact for the forest management unit performance (Lembaga Ekolabel Indonesia 2000b)

Input:
Expert panel I recommendation report (Lembaga Ekolabel Indonesia 2000b)

Output:
Field data for verification (Lembaga Ekolabel Indonesia 2000b)
Process name: 5. Data and Analysis (verification) include verification of Initial typology

Objective:
To analyze and verify data from the forest management plan implementation in the field. (Lembaga Ekolabel Indonesia 2000b)
To verify the conclusion about the initial typology of forest management unit that has been concluded by expert panel I. The conclusion about the initial typology of the forest management unit may be corrected based on field condition (Lembaga Ekolabel Indonesia 2000b)

Function:
Data analysis and verification (Lembaga Ekolabel Indonesia 2000b)

Input:
Field data for verification and basic FMU data and document (Lembaga Ekolabel Indonesia 2000b)

3. Performance Evaluation and Decision Making

Performance evaluation is a evaluation of forest management unit based on criteria and indicators of Sustainable Natural Forest Production Management principles compare with actual and the standards (norm) given to set minimum threshold value in order the forest management unit to pass the evaluation. The evaluation will decide the passing level and its rank of the current evaluated forest management unit (Lembaga Ekolabel Indonesia 2000b).

Actors: Expert Panel II and field Assessor Team

Process name: 6. Performance Evaluation and Decision Making

Objective:
To verify and confirm the information based on the field assessment and input from the community/public, here the assessor should present the field assessment to the expert panel II (Lembaga Ekolabel Indonesia 2000b; Setyarso 2000b)
To analyze the field assessment data and previous expert panel I recommendation, conducted by expert panel II (Lembaga Ekolabel Indonesia 2000b; Setyarso 2000b)
To define a standard value based on verified typology and make a decision based analysis using AHP method compare with the standard value, conducted by expert panel II (Lembaga Ekolabel Indonesia 2000b; Setyarso 2000b)

Function:
Auditing function based on field data assessment and existing information (basic forestry document and basic data) (Lembaga Ekolabel Indonesia 2000b; Setyarso 2000b)

Input:
Field Assessment data include presentation of information by field assessor team
Input from community

Output:
Evaluation and recommendation which contains grade level which reflects FMU performance. The grade level is the output from AHP, that in principle it comes
from actual value achieved by the FMU here then is compare to set of grade standard value defined by expert Panel II (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b; Setyarso 2000b). LEI SNFPM scheme prescribed the rating value / grade rating are Gold, Silver, Copper, Zinc, Bronze. If the rating scale is between Gold-Copper then the FMU is pass but if the rating scale is Zinc-Bronze then FMU is failed to get the certification (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b). The recommendation is include the input for improving the forest management practice (Salim, Djalins et al. 1993; Lembaga Ekolabel Indonesia 2000b).

4. Decision and Affirmation
Decision and Affirmation is a process to certify the expert panel II become the certification decision of certification body. If the forest management unit is declared pass the SNFPM evaluation process then the certification body will announce it through the public media, letter of announcement to other stakeholders.

**Actors:** LEI, Certification Council, Public and Certification body

**Process name:** 7. Decision and Affirmation

**Objective:**
To certify the evaluation process become the valid and legal regularity of the certification (Lembaga Ekolabel Indonesia 2000b)
To inform the public about the certified forest management unit (Lembaga Ekolabel Indonesia 2000b)

**Function:**
Confirmation of the evaluation process become valid and regularity legal

**Input:**
The Evaluation and recommendation report of performance evaluation and decision making process.

**Output:**
The Certification letter and public announcement

**Process:** 8. Surveillance

**Actors:** Personal that have qualification as expert panel or Head of the field assessor (Lembaga Ekolabel Indonesia 2000b)

**Objective :**
To protect the credibility of certification decision,
To ensure and monitor the certified FMU for continuing and improving the forest management practice (Lembaga Ekolabel Indonesia 2000b)
To received and follow-up the certification process whenever there is a complain against certification decision (Lembaga Ekolabel Indonesia 2000b)

**Function:**
Evaluation and Monitoring process (Lembaga Ekolabel Indonesia 2000b)

**Input:**
Previous evaluation and recommendation report activity
Basic FMU data include the updated information

**Output:**
Surveillance report as prescribed by LEI Guideline 99 document and it will inform officially open for the public.

### 2.3. Conclusion
The Developed Sustainable Natural Forest Production Management (SNFPM) Certification System is based on the existing the Natural Forest Production Management System (Information product based). The SNFPM certification system apply a certain standard which is consider as a reference or comparable tools for evaluation. However as a system the SNFPM certification is still open for improvements (Lembaga Ekolabel Indonesia 2000a). Because in the SNFPM certification model, the elements of spatial and remote sensing is mentioned as source of information therefore remote sensing and geographic information technology may have a role as tools for improving the SNFPM certification process (Bernhardsen 1999). In order the remote sensing and geographic technology is successful integrate in the SNFPM certification process, it requires the model analysis of the SNFPM certification model to identify which process that needs improvements. However because the SNFPM certification process involves so many processes, for this research the process no 1. Information analysis and determination of initial typology of the forest management unit has been selected (see figure 2.2-3), because this process consider as a first crucial process for analysis of the information that comes from the forest management unit. Improving this process using the remote sensing and geographic information technology may be helpful to improve the SNFPM certification process.
CHAPTER 3.

THE DETERMINATION OF THE TYPOLOGY OF THE FOREST MANAGEMENT UNIT

3.1. Introduction

The current Sustainable Natural Forest Production Management (SNFPM) certification model diagram shows the flow of spatial and remote sensing data include other related information as well as the source of information for verification (see figure 2.2-1, figure 2.2-2). One of the possible alternative improvement of the current SNFPM certification system is the use of Remote Sensing and GIS technology as a tools in to support the certification process, i.e. process no 1. Information analysis and determination of initial typology of the forest management unit (see figure 2.2-2), because this part has a function as same as information system that analyze the data, data management and Initial starting activity to understand the typical condition of the forest management unit. The first part of this chapter (section 3.2) will discuss about the concept and its information needs of the present determination of the typology of the forest management unit. The second part (section 3.3) will discuss the development of the model for the detail process no 1. Information analysis and determination of initial typology of the forest management unit (see figure 2.2-2). A part of this process the model for the determination of initial typology of the forest management unit will be developed and will be elaborated more further details and identify which process that can incorporate the remote sensing and GIS to improve the determination process of the typology of the forest management unit.

3.2. The Information Needs of The Determination of The Typology of The Forest Management Unit

The evaluation of the forest management unit should be fair and transparent (Lembaga Ekolabel Indonesia 1995). To minimize bias because of the forest ecological condition and its social constraints that might became a weighted factor. The Ecological and Social factors might became a constraint factor for example because a lot of steepest area then the management unit can not reach a maximum performance on a certain indicator therefore based on this condition in evaluation a standard acceptable value for that indicator may be enough only in minimum performance level (Lembaga Ekolabel Indonesia 2000b). The LEI SNFPM certification system, classify the forest management unit according to its vulnerability that caused by the ecological and social condition (Lembaga Ekolabel Indonesia 2000b). The role of the typology of the forest management unit in SNFPM certification system is indicated in the diagram model in figure 3.2-1.
Figure 3.2-1. The Role of The Classification (Typology) of The Forest Management Unit Based On The Environment / Ecological Condition and Social Constraints in the SNFPM Certification Process (see the relation of the process with figure 2.3.1-1 and figure 2.3.3-2). Source: Adopted from (Lembaga Ekolabel Indonesia 2000b)
Figure 3.2-2. Flowchart Diagram of The Present Process of Classifying The Forest Management Unit in the LEI SNFPM Certification System. The Classification is based on the Environment / Ecological and Social Condition. All of this processes is done under the process no1. Information analysis and determination of initial typography of the forest management unit, Except the process in the box with discontinued line.

(source from: interviews and (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b))

The detailed processes and information needs of figures 3.2-2 are elaborated in the next pages.
A. The determination of typology of forest management unit based the environment / ecology

The LEI SNFPM certification system defines that the typology of the forest management unit based on environmental / ecological conditions are determined by two factors i.e. Degree of Habitat Fragmentation and Location (geographical properties) of Forest Management unit in regional context.

A.1. The degree of habitat forest fragmentation

The condition of the fragmented habitat defines the setting of the management unit that inherently will influence the intensity of the sustainable natural production forest management according to its ecological / environmental principles. Fragmentation causes a constant obstacle of three important things: distribution, dispersal and genetic flows from one sub population to other surrounding sub population (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b). (Morrison, Marcot et al. 1992) consider the prevention of habitat fragmentation as an important to maintain ecological unit as a system in forest ecosystem.

The standard for defining Degree of Habitat Fragmentation. (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Criteria:
Connected if more than 50% of boundary of management unit is directly connected with the ecosystem or another natural forest in its surrounding.
Semi-fragmented if less than 50% of boundary of the management unit is directly connected with the ecosystem or another natural forest in its surrounding.
Fragmented if there is no connection between boundary of management unit with the ecosystem or another natural forest in its surrounding

<table>
<thead>
<tr>
<th>Table 3.2-1. The Sensitivity scale of the habitat fragmentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmentation Degree</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Fragmented</td>
</tr>
<tr>
<td>Semi-fragmented</td>
</tr>
<tr>
<td>Connected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3.2-2. Information needs for determining degree of habitat fragmentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data/source</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Vegetation derived from recent satellite image</td>
</tr>
<tr>
<td>FMU working plan map</td>
</tr>
</tbody>
</table>

source: interviews and (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)
A.2. The Location (geographical properties) position of Forest Management Unit

Location / geographic properties of forest management unit here is defined by two factors i.e. (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

A.2.1. Biological Condition

Biological condition of forest management unit is influenced by the level of biological sensitivity of the area e.g. conservation area, biodiversity, endangered species habitat etc.

The standard for defining Biological condition of forest management unit (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Criteria:
- **Biological safe** if the forest area within forest management unit is forming an ecological entity with another natural ecosystems, especially those who need biological protection e.g. with another nearby conservation area / share a common border with protection area.
- **Biological not safe** if the forest area within forest management unit is not forming an ecological entity with other natural ecosystem, especially those who need biological protection e.g. with another nearby conservation area / share a common border with protection area.

Table 3.2-3. Information needs for defining biological condition

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Present assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation derived from satellite image</td>
<td>Current vegetation / forest cover condition</td>
<td>Superimposed vegetation map + FMU working plan map + RTRWP/TGHK + river and conduct visual analysis to analyze the ecological entity based on the criteria as prescribed</td>
</tr>
<tr>
<td>FMU working plan map</td>
<td>Boundary of FMU, protected area defined by slope/physical condition Sometimes defined by community and FMU Is there a habitat corridor that connected each other?</td>
<td></td>
</tr>
<tr>
<td>RTRWP + TGHK</td>
<td>Spatial Land use plan (local government version), protected area defined by law</td>
<td></td>
</tr>
<tr>
<td>Hydrology/river map</td>
<td>Protected area 200 m left-right around river in management unit</td>
<td></td>
</tr>
</tbody>
</table>

source: interviews and (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)
A.2.2. Physical Environment location

Physical environment location is influenced by physical environment sensitivity of the area e.g. soil condition, rainfall, topography (slope), location of FMU within catchments area (upland or lowland) (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b).

The standard for defining physical environment condition of forest management unit (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Criteria:
*Physical environment safe* if the forest area of forest management unit is not located within macro physical environment that is sensitive to inference e.g. sensitive to erosion, upper area within catchments area system etc.
*Physical environment not safe* if the forest area of forest management unit is located within macro physical environment that is sensitive to inference e.g. sensitive to erosion, upper area within catchments area system etc.

Table 3.2-4. Information needs for defining physical environment condition

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Present assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMU working plan map</td>
<td>Cutting Block and Boundary of management</td>
<td>Superimposed boundary management unit with catchments unit area to look at position of management unit, Calculate slope class percentage with combination with soil and geology to identify how much total area that susceptible to erosion compare with total area and SEL/EIA report (actual)</td>
</tr>
<tr>
<td>Topographic map</td>
<td>Derived slope area to calculate percentage of slope according to the common criteria</td>
<td></td>
</tr>
<tr>
<td>Hydrology map</td>
<td>Location of catchments unit area</td>
<td></td>
</tr>
<tr>
<td>Soil map</td>
<td>Soil condition that sensitive to erosion</td>
<td></td>
</tr>
<tr>
<td>Geology map</td>
<td>Geological formation that sensitive to erosion/landslide</td>
<td></td>
</tr>
<tr>
<td>Land System*</td>
<td>Land condition (include soil+geology+slope)</td>
<td></td>
</tr>
<tr>
<td>SEL/EIA report</td>
<td>actual erosion, impact after logging activity per each RKL</td>
<td></td>
</tr>
</tbody>
</table>

* alternative source information if the soil and geology information is not available

source: interviews and (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)

Then the sensitivity scale for Location (geographical properties) of the forest management unit is combination biological condition and physical environment condition (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b).
Table 3.2-5. The Sensitivity scale for the location (geographical properties) of the forest management unit

<table>
<thead>
<tr>
<th>Location</th>
<th>Biological not safe</th>
<th>Biological safe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physically not safe</td>
<td>03</td>
<td>02</td>
</tr>
<tr>
<td>Physically safe</td>
<td>02</td>
<td>01</td>
</tr>
</tbody>
</table>

Finally then to the determination of typology of the forest management unit is based on the sensitivity scale which combination of the sensitivity scale of the degree of habitat fragmentation and the sensitivity scale of Location (geographical properties) of forest management unit (Lembaga Ekolabel Indonesia 2000b).

Table 3.2-6. The sensitivity scale of the typology of forest management unit based on environment / ecological condition

<table>
<thead>
<tr>
<th>Location</th>
<th>Fragmented</th>
<th>Semi-fragmented</th>
<th>Connected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological-physical not safe</td>
<td>03</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>Biological not safe – physical safe or Biological safe – physical not safe</td>
<td>02</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>Biological - physical safe</td>
<td>02</td>
<td>01</td>
<td>01</td>
</tr>
</tbody>
</table>

Note: The more higher of sensitive value, the more sensitive / vulnerable risk of ecological system of FMU

B. Determination initial forest management unit type based on social aspect

The more serious social issues that require the needs of allocation of forest resources for the community that are directly or indirectly independent on these forest across generation, the higher the focus of the management unit should be addressing this issue. The LEI SNFPM certification scheme prescribes two stages for typology of forest management unit determination based on social aspect, i.e. Initial Social Typology of FMU and Final Social Typology of FMU (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

Variable factors that influence the Initial Social Typology of Forest Management Unit

The social typology of forest management unit is influenced by four major factors, i.e. (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

B.1. Production technique

The production technique reflects to the intensity and quality way the local community benefit from natural resources of forest. Different production technique will influence and be influenced by the area or zone to be used.

The standard for defining production technique (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Hunting and Gathering Communities largely fulfill their primary needs through hunting wild animal and gathering forest products i.e. for self use not commercial gains. Hunting and Gathering communities are nomadic
Rotation Farming Communities conduct their farming through a process cut/slash and burn rotation. This community occupies the area for specific period coinciding with the farming cycle.

Dry-land Permanent Farming Communities cultivate their land on a continual basis with food crops for their own consumption and or perennial crops. They are community who occupies the area for long period.

Intensive Farming Communities are communities who cultivate their land with wet crops and occupy area for a long period.

Table 3.2-7. Information needs for defining production technique

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Present assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Economic Survey Reports and or Statistics reports of Villagers, RKPH (20 years forest plan), EIA report</td>
<td>Production technique</td>
<td>identify the production technique every village surrounding, verification data: living place, production cycle, irrigation system, production commodities, production technology</td>
</tr>
</tbody>
</table>

Source: (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)

B.2. The Utilization Zone

The utilization zone factors is zone exploitation within a distance and overlap of an area claimed to be zone for exploitation community, (as a result of social, economic and cultural interaction) with an area which has become a working zone of a management unit. The zone of exploitation shows the interaction between management unit and local community in relation to gain the benefits from forest resources (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

The standard for defining utilization zone (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Outer Zone if the boundaries that are claimed by surrounding communities are outside the management unit.

Overlap Zone if part of the claimed area by surrounding communities are within concession area.

Inter Zone or Enclave if all the area that are claimed by surrounding communities are within concession area.
Table 3.2-8. Information needs for defining utilization zone

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic study, EIA report, SEL report</td>
<td>Zone of Exploitation of forest community</td>
<td>Verify and confirmation with management unit during field scoping process. Verification data: movement zone for economic, social and religion culture activity, location of cultivated area, location of wood production within FMU area.</td>
</tr>
<tr>
<td>(Environment Evaluation Study report), Forest protection and security report, Social maps of forest management unit, Boundary and register reports</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)

B.3. Density of Population Level

The different level of population density is believed to cause individuals to strive for more space i.e. expansion. In interacting with management unit the variable is crucial for higher concentration level, the more tendency there is to exploit more land intensively if high technology is employed or extensively if low technology is used (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

The standard for defining density of population level (based on Indonesian agrarian density) (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Population density is Low if the value > 1.5
Population density is Middle if the value > 1 to 1.5
Population density is High if the value < 1

The value is reflect the needs of land required per family in settlement unit area, the more higher value indicates that the more tendency there is to exploit more land to fulfilled their needs.

The value is defined from calculation based “ideal agrarian density” (ratio for land required per family head/individual compare to technology developed by its community). High, middle and low classes are based on comparison between the total cultivated/processed land area (including utilization zone) and the land area required by the relevant community (total population x land area needed by one family / individual in line with technology developed by the community) (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

Table 3.2-9. Information needs for defining density of population level

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Present assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Economic Survey Reports and or Statistics reports, diagnostic study, social report, Village report</td>
<td>Number of population per village and total of their cultivated / processed land</td>
<td>Verify and confirmation with FMU. Verification data: population growth, population density, accelerated of cultivated area, population migration and mobility, livelihood</td>
</tr>
</tbody>
</table>

Source: (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)
B.4. Production Motive

The production motive will have direct bearing on the intensity of forest resources exploitation that affects relationship with the management unit (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

The standard for defining production motive (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

- Subsistent if only to fulfill daily needs
- Commercial if the gains are aimed at accumulation of capital

Table 3.2-10. Information needs for defining production motive

<table>
<thead>
<tr>
<th>Data/source</th>
<th>Information needs</th>
<th>Assessment methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic study, EIA report, SEL report (Environment Evaluation report), Expert Panel Knowledge</td>
<td>Production motive</td>
<td>Verification and confirmation with FMU. Verification data: live activity, production orientation, secunder production service, trading system</td>
</tr>
</tbody>
</table>

Source: (Agung and Hinrich 2000; Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)

Based on evaluation of four important factor, then the combination of that factors, LEI SNFPM scheme provide the cross-section which reflects the sensitivity value of Social Typology (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

Table 3.2-11. The Sensitivity scale of Social activity of Forest management in Indonesia

<table>
<thead>
<tr>
<th>(1) Production Technique</th>
<th>(2) Utilization Zone</th>
<th>(3) Density level of population</th>
<th>(4) Production Motive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outer Zone</td>
<td>Overlap</td>
<td>Inside / Enclave</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Middle</td>
<td>High</td>
</tr>
<tr>
<td>Hunting and Gathering</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Rotation Farming</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Dry-land permanent Farming</td>
<td>07</td>
<td>08</td>
<td>09</td>
</tr>
<tr>
<td>Intensive Farming</td>
<td>01</td>
<td>02</td>
<td>03</td>
</tr>
</tbody>
</table>

Note: S = Subsistent, C = Commercial

Then the sensitivity scale of social condition of the forest management unit is classified according to weighting scale. The results of classification is indicated in table 3.2-12 (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)
Table 3.2-12. The Classification of The Sensitivity scale of the social activity of the forest management unit

<table>
<thead>
<tr>
<th>Degree of Sensitivity</th>
<th>Typology of UM</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-18</td>
<td>01</td>
</tr>
<tr>
<td>19-36</td>
<td>02</td>
</tr>
<tr>
<td>37-54</td>
<td>03</td>
</tr>
<tr>
<td>55-72</td>
<td>04</td>
</tr>
</tbody>
</table>

Note:
01 = securely safe, it means that forest management unit has no social constraints to implements the forest management practice. The forest management unit should able to reach maximum performance.
02 = safe, it means that forest management unit has no social constraints however there are possibility that the some variable of the social constraints will become a social constraint that might influence the forest management performance.
03 = somewhat safe, it means that the forest management unit has social problem but it is not consider as constrain. However for the social management it should become the priority in the forest management.
04 = not safe, it means that the forest management unit has a social constraints therefore what ever management implementation or its activities conducted by the forest management unit, the forest management unit might have difficulty to reach maximum performance at some indicators

for example to give an illustration how to determine the social typology:

Based on verification and confirmation, it gives information that:
- production technique is hunting and gathering communities
- utilization zone is inside/enclave
- density of population level is low
- Production Motive is subsistent

Based on the Sensitivity scale of social activity of Forest management in Indonesia, the sensitivity value of this social typology FMU is 67. Then according to the classified sensitivity scale of social activity is classed as 04. So the Initial typology of Forest management unit is 04.

However it is not enough defining social typology of FMU based on that four factors so LEI SNFPM scheme provides the advanced analysis which is based on field assessments reports (assessor reports) and other information which is considered important by expert panel that it will influence the social typology of forest management unit. The final social typology of forest management unit will be (Lembaga Ekolabel Indonesia 2000b)

C. The Final Determination Final Social Typology of Forest Management Unit

LEI SNFPM scheme consider some factors / variables that will influence the social typology determination, i.e.
1. Variety of source income
2. Period of operation of unit management / health of management
3. The vulnerability of the company
4. Actual conflict during present assessment
5. Social economic and other social culture condition that the expert panel and assessor feel that are relevant and significant to determining its social typology type.

For example
If Initial typology as an illustrated before is 04 then because of the production technique is vary and the forest management unit has a good relationship with the forest local community because the forest management unit has a good strategy and
planning to minimize the possible conflict, in the present and coming period within their forest management unit work area, so in this case the typology social may be changed into categories 02.

D. The Final Conclusion of Determination The Typology of Forest Management Unit

Based on two main factors that influence the determination of typology of forest management unit. The final conclusion of typology of forest management unit is the combination of that two factors, i.e. Environment/Ecology and Social. The result is sensitivity scale of typology of forest management unit (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b).

Table 3.2-13. The Final Conclusion of Typology of Management Unit Based on Environment and Social Aspect

<table>
<thead>
<tr>
<th>Social Typology of Management Unit</th>
<th>Management Unit Typology Based on Environment/Ecological Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>02 03</td>
</tr>
<tr>
<td>01</td>
<td>1 safe 3 safe 5 technology</td>
</tr>
<tr>
<td>02</td>
<td>2 safe 4 safe 6 technology</td>
</tr>
<tr>
<td>03</td>
<td>7 social 9 social 11 socio/techno</td>
</tr>
<tr>
<td>04</td>
<td>8 social 10 social 12 socio/techno</td>
</tr>
</tbody>
</table>

Note
- Condition safe (1-4)
- Condition requires technological innovation to minimize negative effect of ecosystem environment
- Condition requires management innovation to minimize negative effect of social environment
- Condition requires technological and management innovation to minimize effect of environment and social

The typology of forest management unit should be used by the management for reference information in planning activity. The priority for forest management plan should contain the strategy to anticipate the constraints because the forest environment and social aspect (typology of forest management unit reflects the major problem or constraints). For example if the typology of forest management unit is 02 then it categorized as safe condition, it means that there are no constraints caused by forest environment and social condition. The implication is that the forest management unit should able to reach good performance in the forest management activities (output management dimension). This consideration is important for the expert panel during decision making process in the SNFPM certification process (Lembaga Ekolabel Indonesia 2000b).

3.3. The Present Model for the Determination Process of The Initial Typology of The Forest Management Unit

The present assessment information model for the Initial typology of the forest management unit can be developed based on detail explanation of figure 3.2-2 and the detail elaborated and description in information needs analysis (sub section 3.2) and It is the detail process of the process no 1. Information analysis and determination of initial typology of the forest management unit (see figure 2.3.3-2). Based on interviews and (Agung and Hinrich 2000; Setyarso 2000a) the detail of this process will divide the process into three major sub processes, i.e. 1. Information
analysis (which is divided into two parts, analysis for spatial data and analysis for documents / non-spatial analysis), 2. the determination of Initial typology of the forest management unit and 3. collection information for verification.

Figure 3.3-1. Detail Process Diagram for process no1. Information Analysis and Determination of The Initial Typology of The Forest Management Unit Mode. The Model is the first level diagram from process no 1. in diagram indicated in figure 2.2-3. (Source: Interview and (Setyarso 2000a); (Agung and Hinch 2000)).

The detail description of this model will be elaborated in the next page.
General Description of figure 3.3-1.
This process consists of three major activities, i.e.
1. Information Analysis which consists of two parallel processes, i.e.

**Process no. 1.1a. map (spatial) and remote sensing data analysis**
The present analysis method: *quick manual analysis* (Setyarso 2000a)

**Objective**
To analyze the spatial and remote sensing data of the forest management unit. The analysis aims to extract the information about the geographical and spatial environmental condition of the forest management unit (Setyarso 2000a).

**Function**
Central data processing for spatial analysis include the analysis for remote sensing data (Setyarso 2000a).

**Input**
Spatial data (maps) the forest management unit and remote sensing data (images). These data are available as attachments maps in the 20 years forest management plan (RKPH) (Setyarso 2000a).

**Output**
Map analysis results for verification. The output information of this process should be clarified with the forest management unit (Setyarso 2000a).
The supported data and information for assessment of typology of the forest management unit, i.e. FMU boundary + RKL, catchments area, slope class, spatial land use plan (TGHK+RTRWP), soil and geology or land system, protected area, village location, updated vegetation and or previous vegetation, accessibility to forest management unit area (Setyarso 2000a).

**The process analysis and suggestion for improvements**
This process has a function as a main central data processing for the spatial and remote sensing data. This process however has a main function as information system that supports the first stage SNFPM assessment process (see figure 2.3.3-2), because in this process all of the spatial and remote sensing data and other related information is collected from the natural forest production management system (see figure 1). Therefore here in this process remote sensing and GIS technology can play a role to support the SNFPM certification process. The information system based on remote sensing and GIS will become a powerful tool for the supporting the information analysis of this process (Abel, Ooi et al. 1998). This process will be a system supports that provide the information needs for the next process (the decision making process / scoping process, see figure 2.3.3-2).

**Process no. 1.1b. Document Analysis (non spatial analysis)**
The present analysis method: *quick reading methods* (Setyarso 2000a)

**Objective**
To analyze basic forestry document of the forest management unit. The analysis aims to extract the information about the forest management aspects, i.e. the
business activities, technical forestry operation and silviculture activities of the forest management unit. (Setyarso 2000a)

Function
central information processing for non analysis include the study of basic forestry documents (Setyarso 2000a)

Input
Basic forestry documents, i.e. forest plan documents, forest management implementation documents, environment management documents, social management documents, auditing and monitoring documents, financial and accounting reports, FMU personal data, other documents as required (Setyarso 2000a).

Output
Document analysis results for verification. The output information of this process should be clarify with the forest management unit.
The supported data and information for assessment of typology of the forest management unit, i.e. production motive, utilization zone, production technique, population density, actual erosion and environment impact.

The process analysis and suggestion for improvements
This process requires a lot of work to be done, therefore during the training expert panel should able to apply the method quick fast reading (Setyarso 2000a). However because the main function of this process is as a central data processing for non spatial data, therefore it is important to have a main data system (database management system) that supports the assessment of initial typology and the next analysis process. The suggestion is not to remove the present method (quick fast reading method) because this method is proven useful to help the expert panael to analyze a lot of document and material. The establishment of database system is to make easy to manage the information so whatever information results it might be better to store it in the database system.

2. The assessments of the initial typology of the forest management unit

Process: 1.2. Determination of the initial typology of the forest management unit
This process will be more further elaborated in the detail process. The further elaborated model of this process is developed based on the description of the figure 3.2-2 and the description of information needs analysis (sub section 3.2). The detail developed of this process is indicated in figure 3.3-2.

3. Collection of Information for Verification / Reporting

Process name: 3. Information Confirmation
Objective:
To confirm and verify the information analysis with the forest management unit (Setyarso 2000a)

Function:
The collection of Information from the Information analysis process / reporting function (Setyarso 2000a)
Input
Information analysis product from process no 1 (no 1.1a. and 1.1b.)

Output
Information for verification and confirmation (see figure 2.2-2) (Setyarso 2000a)

Figure 3.3-2. The Detail Process of Process no. 1.2. The Determination of Initial Typology of The Forest Management Unit. The Model is the second Level Diagram from the process no 1 of the diagram indicated in figure 2.2-3 (Source: Interview and (Agung and Hinrich 2000) (Mutu Agung Lestari Ltd 2000; Lembaga Ekolabel Indonesia 2000b)

3.3.1. The general description for the determination model of typology of the forest management unit based on ecological aspect (figure 3.3.)

Process no. 1.2.1. The Determination of the typology of the forest management unit based on ecological aspect.
To determine the typology of the forest management unit based on ecological aspect, the SNFPM certification system consider two factors which determine the ecological condition, *i.e.* degree of habitat fragmentation and location (geographical properties) of the forest management unit (see general process in figure 3.2-2). Therefore this process will described in the detail process which is shown in the following figure 3.3-3.
**Figure 3.3-3. The Detail process of process no 1.2.1. The Determination of The typology of the forest management unit based on Ecological Aspect of figure 3.3-2.** This process is the detail level the process no 1.2. of figure 3.3-1 and this process is the third level diagram from the process no. 1 of the process indicated in the diagram of figure 2.2-3. Source: (Interview and (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

The general description of figure 3.3-3.

**Process no 1.2.1.1. Degree of habitat fragmentation**

**Input**
The information input for this process are mainly spatial data, i.e. vegetation (updated) and FMU boundaries.
The Standard is refer to the sensitivity scale (see table 3.2-1)

**The present assessments process** (Source : interview)
- Superimposed manually the FMU boundaries with vegetation (updated) or color composite of the satellite image (hardcopy) that enhance the information about vegetation condition.
- Analyze the forest fragmentation by measure how much boundary of the FMU that does not connected to another forest area. The forest area can be easily identify from the color composite of the satellite image (hardcopy)

**Output**
the output is the sensitivity value which reflects degree of habitat fragmentation of the forest management unit
The suggestion for improvement
The current process shows that the analysis for determining the degree of habitat fragmentation is based on the recent satellite image and it is in color composite hardcopy format. The hardcopy format usually has already been manipulated by photographic technique which is possible for manipulate the color of the image. Therefore for the suggestion it is more better to use original satellite image in digital form. The current digital image processing technology combined with GIS data may be powerful to analyze and enhance the process analysis to determine the degree of habitat fragmentation (Roberts, Hall et al. 2000).

Process 1.2.1.2. Location condition (geographical properties) of the forest management unit
This process based on information needs analysis (section 3.2.) is determined by two variables, i.e. biological condition and physical environment condition (see figure 3.2-2). This process will be elaborated in detail process in the following figure.

Figure 3.3-4. The Detail process of the process no 1.2.1.2. Location (geographical properties) of the forest management unit of figure 3.3-3. This is the detail level of the process no. 1.2.1 of figure 3.3-2 and it is the detail level the process no 1.2. of figure 3.3-1 and this process is the third level diagram from the process no. 1 of the process indicated in the diagram of figure 2.2-3. (Source: Interview and (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b))

The general process description of figure 3.3-4.

Process 1.2.1.2.1. Analysis of the physical environment condition

input
Data and Information which can be categorized into:
- Spatial data: catchments area, soil and geology (or land system), protected area and vegetation condition, slope class, spatial land use plan
The standard for defining physical environment condition of forest management unit
(Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)

Criteria:
Physical environment safe if the forest area of forest management unit is not located within macro physical environment that is sensitive to inference e.g. sensitive to erosion, upper area within catchments area system etc.
Physical environment not safe if the forest area of forest management unit is located within macro physical environment that is sensitive to inference e.g. sensitive to erosion, upper area within catchments area system etc.

The present analysis process (source: interview)
- Analyze the location of the forest management unit boundaries within the catchments area, where is the location? Upper or lowland
- Calculate the slope area (using ministry of forestry standard) and calculate the total steep area compare to the total area.
- Analyze from the Soil + Geology condition (or Land System) compare to the forest management unit boundaries. The analysis is aims to get the suitability of the location of the forest management unit area based on soil + geology condition
- From the EIA report, the information about actual erosion and the rainfall per year can be extracted
- Conclude the macro physical condition based on analysis location of the FMU within the catchments area, total steep slope to total FMU area, suitability condition, total erosion per year per RKL, rainfall per year.

Output
The output is information about the physical environment condition (safe or not safe)

The suggestion for improvements
The current process analysis shows that most of the analysis are based on manual and quick reading of the existing report, i.e. the macro physical condition which is indicated the 20 years management plan report (RKPH) see the explanation of figure, 2.1-2 (Setyarso 2000a). To improve this process the use of the GIS technology may enhance the analysis, e.g. the slope can be automatically generated and it calculated from the contour line of the topographic data. So the information of the macro physical condition can be provide in such a way where non spatial information can be relate with spatial information so the expert panel can understand the relationship between spatial data and non spatial data (Improving the visualization and communication technique using GIS mapping) (Lotov, Bushenkov et al. 1997; Devogele, Parent et al. 1998). The multi criteria method may be powerful to improve this process because based on present process analysis it shows that the
determination process is using some criteria to determine the macro physical condition (Tkach 2001).

**Process 1.2.1.2.2. Analysis of the biological condition**

**Input**
The information input for this process
Spatial data: protected area, spatial land use plan (RTRWP+TGHK), FMU boundaries (the original information is coming from process no 1.1b of diagram indicated in figure 3.3-1).

The standard for defining Biological condition of forest management unit (Agung and Hinrich 2000; Lembaga Ekolabel Indonesia 2000b)
Criteria:
- **Biological safe** if the forest area within forest management unit is forming an ecological entity with another natural ecosystems, especially those who need biological protection *e.g.* with another nearby conservation area / share a common border with protection area.
- **Biological not safe** if the forest area within forest management unit is not forming an ecological entity with other natural ecosystem, especially those who need biological protection *e.g.* with another nearby conservation area / share a common border with protection area.

The present analysis process (source: interview)
Analyze the forest ecosystem condition of the forest management unit by identifying the protected or conservation inside and outside the forest management unit, is it share a common border or not?, Is there any conservation area?, is the location of forest management unit are located in the right land use for forest production?
Conclude the macro biological condition based on the analysis of the existing of the conservation or protected area inside or surrounding the forest management unit.

**Output**
The output is information about the biological condition (safe or not safe)

**The suggestion for improvements**
The present analysis is conduct by look at the FMU working plan map which is contain the information about the location of the protected area, the FMU boundaries and spatial land use plan. However this methods seems can be improved with additional spatial data *i.e.* recent vegetation or just display together with the recent satellite image which is reflect the vegetation condition and if it combined with location of conservation or protected area then the expert panel can get more information about the vegetation condition about the protected area, *e.g.* it is protected forest area but why there are no forest area anymore?. This method can be done using GIS technology with enhance of the remote sensing data (Kraak and Maceachren 1999). Therefore GIS technology can improve the communication process to get the information by visualize the information in such a way so the information is useful for the analysis to determine the macro biological condition of the forest management unit (see the complete improvement model in appendix 11).
Process 1.2.1.2.3. Analysis the sensitivity of physical environment and biological condition

Input
The information needs for this process are information from process 1.2.1.2.1 and process 1.2.1.2.2. (see figure 3.3-4). The information contains about the physical macro condition and macro biological condition. The standards as shown in table 3.2-5.

The present process analysis (source: interview)
the expert panel use the physical environment and biological condition based on previous process then the analysis is cross the two information based on table 3.2-5

Output
the output is the sensitivity value which reflects location of environment condition of the forest management unit

The suggestion for improvements
The decision support system may be useful to improve the process because it is automatically assist the user based on available information to select the correct sensitivity scale (see the improvement model in appendix 11).

3.3.2. The general description for the determination model of typology of the forest management unit based on social condition (figure 3.3-1.)

Process 1.2.2. Determination of initial typology of the forest management unit based on social condition
To determine the initial typology of the forest management unit based on the social condition, the detail explanation of figure 3.2-1 indicates that there are four factors influence the social condition i.e. production technique, utilization zone, production motive and production motive. The original information to determine each social factor is coming from the process no 1.1a. (see detail explanation of figure 3.2-1)

Input
The information input about production technique, population density, utilization zone and production motive is coming from the process 1.1a. document analysis (spatial analysis) (see figure 3.3-1). All of these information are found in the forest management plan, i.e. The 20 years management plan (RKH) in section social condition, Environment Impact Analysis in section social condition, Social management implementation report and other supported documents e.g. statistical data of the village from local government (see the description in section 3.2 point B and figure 3.2-2 and the original source is in explanation of detail figure 2.1-3). However the information is supported by the social activities maps which shows the location of the village compare to forest management unit boundaries.

The standard and criteria to determine each variable has been explained in figure 3.2-1, section 3.2. part B. The determination of initial social typology of the forest management unit and Table 3.2-11 and table 3.2-12).

The present process analysis (source: interview)
- Display the social activities maps of forest management unit
- Analyse the production technique, utilization zone, calculate the population density based on the social management reports (20 years forest plan document, EIA documents, Social diagnostic study if available)
- The analysis of the production motive is based on social management reports and the knowledge of the expert panel person, i.e. one of the members of the expert panel is coming from the local area that understand social condition of the forest management unit (Lembaga Ekolabel Indonesia 2000b).
- Make a conclusion based on table 3.2-11. and the results is the sensitivity scale (01 to 72).
- Classify the sensitivity scale based to the social sensitivity scale (table 3.2-12) that reflects the social condition of FMU

Output
the output is the sensitivity value which reflects social condition of the forest management unit

The analysis and suggestion for improvements
To determine the social condition based on the four variable as prescribed, may be difficult because the four variable in reality is vary e.g. the variable production technique may vary in each villages. Therefore it is difficult to make a conclusion if the variable factors are vary. However to improve this process the use of multi criteria method as decision supports may useful because it consider many criteria and allowed compensatory effect so the variability of variable factors can be accommodated (Massam 1999; Saaty 2001).
The road and main river are the facility for the local community to have an access to enter the forest management unit working area. The Local community may be have the utilization area inside the forest management unit. To identify of the possible location of the utilization area, the road and river data can be us with support using remote sensing data as additional analysis to enhance and update the road feature.

3.3.3. The general description of the determination of initial typology of the forest management unit based on the ecological and social condition (figure 3.3-1)

Process 1.2.3. The determination of initial typology of the forest management unit based on ecological and social condition.

Input
The input for this process are the sensitivity value of the ecological sensitivity (process 1.2.1.) and sensitivity value of social condition (process 1.2.2)
The standards for determining the initial typology based on the ecological and social condition (table 3.2-13.)

The present process analysis (source: interview)
The expert panel look the sensitivity value of the ecological sensitivity and social sensitivity condition and according to table 3.2-13., then final sensitivity value of the initial typology of the forest management can be acquired.

Output
The output is the sensitivity value / classification of the forest management unit based on the ecological and social condition.
The suggestion for improvements

The development of the decision support system may be helpful to support this process. The decision support system will assist the users to select the sensitivity value in table 3.2-13 (see the complete improvement model in appendix 11)

3.4. Conclusion

The decision of the forest certification should be fair and transparent therefore the LEI SNFPM scheme classify the forest management unit to minimize the bias of the evaluation during the decision making process. The classification is based on its vulnerability or security risk which influenced by the ecological and social condition. The ecological and social condition is influencing the forest management unit performance because this factors may become the factors that beyond the forest management control or may become the factors that be prioritized for the management and planning of the forest management unit.
CHAPTER 4.

THE DESIGN OF THE INFORMATION SYSTEM FOR THE DETERMINATION PROCESS OF THE INITIAL TYPOLOGY OF THE FOREST MANAGEMENT UNIT

4.1. Introduction
As recommendation to on previous chapter, *i.e.* the model for determination of the topology of the forest management unit and its detail description (figure 3.3-1 and figure 3.3-2), the suggestion is to implements the remote sensing and geographic information system as an integrated tools to improve the process. This chapter will discuss the aspect of system and database design with RS and GIS technology as a tools to support the determination of the topology of the forest management unit.

4.2. The Improvement model for the determination of the Model of the topology of the forest management unit
The improvement of the model is developed based on the suggestion of the model for the determination process of the forest management unit. the model and its description has been discussed previously in chapter 3 section 3.2 and 3.3., the detail of the mode diagram is indicated in figure 3.3-1. From the model analysis it found that the use of spatial and remote sensing data are one of the input data for the process, therefore it is suggested to use remote sensing and GIS technology to improve the process that indicated in the model. The use of remote sensing and GIS technology believe that it will improve the delivery process of the information for the determination of the topology of the forest management unit, *i.e.* improvement of the process in process no 1.1a. and process no 1.2. (figure 3.3-1). The improvement model of the model in figure 3.3-1 is indicated in the following figure (figure 4.2-1).
4.2.1. The modular design (sub system) of the process no 1.1a. Spatial and Image analysis using GIS and Remote Sensing

This process is considered as initial processing process that provide the information required for the process no 1.2. The determination of the initial typology of the forest management unit. The initial processing activities based on the information flow coming out from this process are:

- Geographical Feature updating based on the recent remote sensing data e.g. vegetation map (updated).
- Slope class, which can be derived from contour line of topographic data (the topographic data is part of the “spatial data”, and this has been discussed in chapter 2 in the detail explanation process of figure 2.1-2 and figure 2.2-3)

However this sub process is not only for providing the information for the process no 1.2. the determination of the typology of the forest management unit, but more this sub process will be as a main source of processing data that provide the required
information for the spatial information analysis for another process, as indicated in the figure 4.2-1 there is another information line coming out from this process, i.e. map analysis results, and this information will go to the process no 1.3. together with output from process no 1.1b. the information are collected then it use for the next process in top level diagram model that indicated in figure 2.2-3 in chapter 2.

4.2.2. The modular design (sub system) of the process no 1.2. The determination of the topology of the forest management unit using database and GIS functionality

The modular design of this model and its functionality are defined based on the description of the process for determining the topology of the forest management unit (figure 3.2-2) and the developed model and description of the process of determination of the initial topology of the forest management unit (figure 3.3-1, figure 3.3-2, figure 3.3-3 and figure 3.3-4). The modular design of the improvement of the model indicated in figure 3.3-2 is shown in the following figure 4.2-1

---

**Figure 4.2-2.** The improvement model of the detail process 1.2. The determination of the initial topology of the forest management unit. This process is the second level diagram of the diagram indicated in figure 4.2-1

**Process 1.2.1. The determination of the topology of the forest management unit based on the ecological condition**

The detail of this process has been discussed in chapter 3 sub section 3.3.1. The improvements is this process is now using the remote sensing and GIS technology as
a tools to improve the analysis of the process. The detail functionality of this process as computer based modular sub system is described in the appendix 11.

**Process 1.2.2. The determination of the initial typology of the forest management unit based on the social condition**

The detail of this process has been discussed in chapter 3 sub section 3.3.2. The road and main river are the facility for the local community to have an access to enter the forest management unit working area. The Local community may be have the utilization area inside the forest management unit. To identify of the possible location of the utilization area, the road and river data can be us with support using remote sensing data as additional analysis to enhance and update the road feature. The suggestion is this process for improvements can be described in the detail process using GIS and remote sensing as a tools to enhance the analysis of the possible utilization area inside the forest management unit. The complete improvement model is provided in appendix 11.

![Gane-Sarson Data Flow Diagram](image)

**Figure 4.2-3. The detail process of the process no 1.2.2. The determination of initial typology of the forest management based on the social condition. This process is the detail level the process no 1.2. of figure 3.3-1 and this process is the third level diagram**

The detail process of computer based modular design showing the functionality of each process is indicated in appendix 11. The summary results of the modular design and its functionality from appendix 11 is indicated in figure 4.2-2., the work function will represented by C=Computer and H=Human.
4.3. Proposed Architecture of Information System to support Typology of Forest Management Unit Assessments

The architecture of the information system is proposed using sharing data concept (Abel, Ooi et al. 1998; Laurini and Thompson 1998; Bernhardsen 1999) because of the essence of the forest certification is data verification process. The architecture of
the information system is build according to the figure 4.2-1 and figure 4.2-2. The proposed architecture of the information system that support the process model in figure 4.4-2, will be shown in the following figure

Figure 4.3-1. Proposed system architecture of the information system that support the determination process of the typology of the forest management unit (refer to figure 4.2-1 and figure 4.2-2). (Source: modification model from (Laurini and Thompson 1998; Bernhardsen 1999))

![Diagram of proposed system architecture](image)

4.4. The Data Model for the Determination of The Initial Typology of The Forest Management Unit

The Data model are currently is developed based on identification of the flow of information that coming in the process no 1.2. the determination of the typology of the forest management unit (figure 3.4-1). The database design for the determination of the typology of the forest management unit is starting from data model. The steps consists of three kind of data model, i.e. Conceptual Model, Logical Model, and Physical Model (Clifton and Sutcliffe 1990; Laurini and Thompson 1998; Bernhardsen 1999)

4.4.1. The Conceptual Model

The conceptual model is define based on the information are coming in the determination process of the typology of the forest management unit (process no 1.2 see figure 3.4-1) and surely some of GIS functionality will be an inherent part of the system (Laurini and Thompson 1998; Bernhardsen 1999).

The conceptual model can be developed based on the information flow that coming in the process no 1.2. of the diagram indicated in figure 4.4-1.

The enterprise rule for the model, for example:
- The forest management unit divided the area into RKL bloks
- The district government has many villages
The village has only one social economic data
- The forest management defined from spatial land use plan (RTRWP and TGHK)
- The forest management unit can have many catchments area (DAS)

Figure 4.4-1. The conceptual diagram for application development of the information system that support the determination process of the typology of the forest management unit (refer to figure 4.3-1). (Note: the conceptual is only show the relationship between entities and only show the important attributes of the entity as the information flow in figure 4.2-1)

However the conceptual model needs to refines in order to get a efficient organizing data in a database. This process called normalization (Chapple 2002). The output from normalization process is the Logical Model because it includes the semantics of attributes, and its structure. The refine model is shown in the following figure.
Because the proposed architecture design is using sharing data concept (Laurini and Thompson 1998; Bernhardsen 1999) then for developing the logical diagram, it is necessary to understand what is the meaning of existing data is in order to link with the refines conceptual model, because the differences of the semantics of the data model between the developed model with the existing model in the forest management unit. This can be done by understanding the existing data and its semantic meaning from the forest management unit. To understand the existing data and its semantic meaning from the forest management unit, study on the various document from the forest management unit is required (BFMP 1999; Fakultas Kehutanan UGM 2000; Lewis and Statriyana 2000; Tyrie 2000; Tyrie and Natadiwirya 2000).
The Availability of Spatial Data
The list of existing spatial data and its attributes from Labanan FMU of Inhutani I based on data exploration activity is provide as follows: (see appendix 3)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMU Boundary</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter</td>
</tr>
<tr>
<td>RKL Blok</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter, RKL Unique identifier</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter, vegetation Unique identifier</td>
</tr>
<tr>
<td>Catchments area</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter, catchments /sub catchments Unique identifier</td>
</tr>
<tr>
<td>River</td>
<td>Network Line</td>
<td>Line Unique identifier and Name, River level</td>
</tr>
<tr>
<td>Road</td>
<td>Network Line</td>
<td>Line Unique identifier and Name, Road Status/Level</td>
</tr>
<tr>
<td>Topography</td>
<td>Line</td>
<td>Line Unique identifier and Name, contour identifier</td>
</tr>
<tr>
<td>Land Use Plan RTRWP TGHK</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter, land use Unique identifier</td>
</tr>
<tr>
<td>Administration and Government</td>
<td>Polygon</td>
<td>Unique identifier and Name, Area, perimeter, administrative Unique identifier</td>
</tr>
<tr>
<td>Village Location and the Utilization Zone</td>
<td>Polygon</td>
<td>Village Unique identifier and Name, Area, perimeter</td>
</tr>
<tr>
<td>Land System</td>
<td>Polygon</td>
<td>Unique identifier, Area, perimeter, Land System Unique identifier</td>
</tr>
<tr>
<td>Soil</td>
<td>Polygon</td>
<td>Unique identifier, Area, perimeter, Soil Unique identifier</td>
</tr>
<tr>
<td>Protected Area</td>
<td>Polygon</td>
<td>Unique identifier, Area, perimeter, Protected Area Type Unique Identifier and Name</td>
</tr>
<tr>
<td>Climate</td>
<td>Polygon</td>
<td>Unique identifier, Area, perimeter, Climate Type Unique Identifier and Name</td>
</tr>
<tr>
<td>Satellite Image</td>
<td>Raster</td>
<td>Pixel Value</td>
</tr>
</tbody>
</table>
Others Data (Non Spatial), (original source: (Mutu Agung Lestari Ltd 2000))

<table>
<thead>
<tr>
<th>Object</th>
<th>Type</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Needs</td>
<td>Table</td>
<td>Standard life per population social culture unique ID and name, type of village</td>
</tr>
<tr>
<td>Population data</td>
<td>Table</td>
<td>Village Unique ID and Name, Population number, Utilization Zone ID and Name, area</td>
</tr>
<tr>
<td>Production type</td>
<td>Table</td>
<td>Social culture Unique ID and Name, production type</td>
</tr>
<tr>
<td>Social culture</td>
<td>table</td>
<td>Social culture Unique ID and Name</td>
</tr>
<tr>
<td>Actual Erosion</td>
<td>table</td>
<td>RKL, Erosion rate</td>
</tr>
</tbody>
</table>

Figure 4.4-3. The Entity Relationship Diagram Model for the Logical Database for the process of the determination of the typology of the forest management unit using data and the semantics meaning of Labanan FMU of Inhutani I. (PK = Primary Key, FK= Foreign Key, I1, I2 = Indexed) (source: translation from the refine conceptual diagram of the diagram indicated in figure 4.4.2., see the detail attributes in appendix 13)
4.4.2. The Physical Data Model

The physical design is hardware dependent. The Physical data model is the implementation of the data model within the software system. Based on the proposed architecture design then the physical model will be implemented within software that has the database connectivity module (ODBC) (Microsoft 2002). ODBC is an Application Programming Interface (API) that allows the programmer / user to abstract a program from a database (Roth Consulting 2002). For this research the software system will use MS Access Database to implement non spatial information

Arcview 3.2a for Spatial information implementation, because the existing data are already in Arcinfo coverage and Arcview shape format, then it is more easy to just use the existing data format rather than it implement within a new GIS software system

Both of the software system, supports the ODBC (Online Database Connectivity).

Figure 4.4-4. An example of Physical Data Model Implementation within MS Access. This results is the conversion from the ER diagram schema that indicated in figure 4.4-3 and the conversion of the database tables from the spatial data of the Labanan Forest Management Unit (see the details data model conversion output (schema-DDL) in appendix 13.)

4.5. The Application Design

Within the framework of the application development, the transformation of both data model and system specification (functionality and task requirements) are performed (Laurini and Thompson 1998; Bernhardsen 1999).

The application developments is developed according to system specification which indicated in figure 4.2-2.. The application development consists four major module i.e. Image processing and image interpretation, Information System (GIS and database)
and Decision Support Module. Another important part is the Interface that enabled the user to make interactive communication with four module as prescribed. The application design is based on the design model that indicated in figure 4.2-1 and its functionality (indicated in figure 4.2-2). The application design is using sharing data concept (Laurini and Thompson 1998; Bernhardsen 1999) because the key of SNFPM certification is data verification and confirmation. The proposed application model is shown in the following figure.

Figure 4.5-1. The proposed application design model based on the design model improvements (figure 4.2-1), the system functionality (figure 4.2-2), the proposed system architecture design (figure 4.3-1) and the refine data model (figure 4.4-2). The design shows a sample model of the application to provide the information about the social condition. Source: Modified design from (Laurini and Thompson 1998; Bernhardsen 1999).

The DSS module (Decision Support System Module) is a module that assist the user to determine the option based on the input information from the information system. This module is part of the proposed application design as part of the improvements suggestion. The structured English for programming the DSS module has been shown in figure 4.2-2.
CHAPTER 5.

THE PARTIAL IMPLEMENTATION OF THE INFORMATION SYSTEM FOR THE DETERMINATION PROCESS OF THE INITIAL TYPOLOGY OF THE FOREST MANAGEMENT UNIT

5.1. Introduction

After design the application model for the determination process of the typography of the forest management unit, next steps is testing the model within the software system environment to implement the model and produce the information based on the requirements (Clifton and Sutcliffe 1990). This chapter will discuss about elements and the process in system testing and implementation. The implementation will implement some part of the model that indicated in figure 4.4-1 and its functionality (figure 4.4-2) All of the module will be implemented except the DSS module and the interface development, because it needs to write a structured English language in the programming software because the time limitation.

5.2. Selection Software System for Implementation

The software for testing and implementation is using

- MS Access 2000/2002 for implementing the Database, because it is a popular software that use the relational database and it supports ODBC that provide Advanced Programming Interface (API) to communicate or sharing the data with others software (Microsoft 2002)
- Arcview 3.2a Desktop GIS software is selected because is known easy to integrate the data (share data and support ODBC)
- Arcview Extension extension, e.g., for GIS application: Spatial Analyst 2.0a, Model builder, 3D Analyst, B.I.T.S polygon tools, Xtools, Identify feature within distance (Jenness 2001), for remote sensing data processing: Image warp 2.0 (Mc Fay 1998) and ECW ER- Mapper plug-ins ver. 2.4.

For processing the remote sensing data, because the requirements prescribed that it is only for simple image processing i.e. updating existing GIS layer then it is consider enough to use Arcview Extension, rather than using other commercial remote sensing software because the assumption are:

- The remote sensing data are collected from the forest management unit that already have corrected (geo-corrected and atmospheric error corrected) and ready for use for further processing.
- The requirements of information from remote sensing data for determining the typography of the forest management unit is only provide the recent forest condition e.g. recent vegetation cover condition, percentage of non forest area, settlements location, etc.
However these assumption are valid as long as there are no additional information needs that is considered by expert panel or assessor team, during the determination of the typology of the forest management unit. For the case study, the data about ecological and social conditions is collected from Labanan Forest Management Unit of PT Inhutani I (with permission from PT Inhutani I). All data is based on information requirements stored in the same digital format *i.e.* Arcview shape file format (.shp) and all of remote sensing image data is stored in Erdas .LAN format or .ERS or .ALG ER-mapper format.

5.3. The Ecological Conditions of The Forest Management Unit

5.3.1. The Habitat Fragmentation Condition of The Forest Management Unit

(Platt, Schanta et al. 1992) explained the potential of remote sensing data to support the monitoring activity by providing recent data for updating the existing GIS layer for National Park Management. Furthermore (Laurini and Thompson 1998) explain the advantage of remote sensing data as a source information for updating the GIS layer. Within the integrated of typology assessment process, remote sensing may useful to help the analyst to see the dynamic change of vegetation condition, road identification etc., to provide the current information about forest characteristics (information for determining the degree of habitat fragmentation) as shown in figure 5.1.

Figure 5.3-1. An example of the use of remote sensing data for updating the GIS layer in Arcview Software with with ECW ER-Mapper Plug-ins ver. 2.4

For delivering information on the determination of the degree of habitat fragmentation, remote sensing data will provide useful information about recent condition of forest vegetation as shown in figure 5.3-2. The forest fragmentation condition of Labanan management unit is measured from the boundaries of the FMU that are not connected to another forest with help of backdrop of updated vegetation layer. The measurement is using the available measure distance sub module in Arcview 3.2a. The result of the boundaries lengths measurements is written in the dbf
table manual or automatics with help of Avenue programming. For the visualization purpose the graphical chart is produced to enhance the visualization analysis and the remote sensing image from the recent acquisition is also shown so the analyst can compare visually of the vegetation condition with recent remote sensing data. Based on the map indicated in figure 5.3-2, it shows that the forest fragmentation condition of the Labanan forest management unit is about 36.5 km out of total 133.5 km of the FMU boundaries length that is not connected to another forest ecosystem, because northern, north eastern and southern east part of the Labanan is surrounded by settlements and non other forest use (alang-alang, agriculture etc). This information indicates that the fragmentation level of the Labanan forest management unit is semi fragmented and the sensitivity value is 02 (see table 3.2-1 and chapter 3, section 3.2 part A)
Figure 5.3-2. Sample Map from The Information System showing information about the forest fragmentation Condition. Source: GIS analysis and (Mutu Agung Lestari Ltd 2000)
5.3.2. The Location (Geographical properties) Environment Condition of The Forest Management Unit

The location of environment condition is defined by the biological condition and physical condition which have been discussed in chapter 2, section 3.2, sub section A.2.1 and A.2.2, and the section 3.3., sub section 3.3.1.

The Labanan Forest management unit was not located at or is not sharing the common border with the conservation area and other area that should be protected. The only protected area shown in the map is only the protected area defined by Labanan forest management unit e.g. biodiversity, steep and soil condition etc.

Figure 5.3.3. An example map from the information system showing the location of Labanan Forest Management Unit compare to location of conservation and protected area (Biological Condition). Source from GIS analysis and (Mutu Agung Lestari Ltd 2000)
The information of the biological condition indicated from the macro conditions of the location of the conservation and or protected area (see the description in chapter 2 section 3.2, sub section A.1.2). The Labanan forest management unit has was not located on the protected area. The forest area surrounding the Labanan forest management unit is the forest that has a function as forest production unit (KPHP), in other word it can be concluded that there is no indication that the Labanan shares a common boundaries with other forest area that should be protected (by law or other convention), because of this condition, the forest area of the forest management unit is categorized into “not safe area”, means that the management unit should be carefully selected the management activity because the sustainability of the ecology depends on the integrity of the ecological function within forest area of Labanan FMU (Mutu Agung Lestari Ltd 2000).

The Physical Environment of The Forest Management Unit

Using GIS applications, the physical environment condition about the forest management unit can be delivered. The physical environment condition is indicated by the physical macro condition which has already discussed before in chapter 3, section 3.2 sub section A.2.2. The macro condition may be indicated from the location of the management unit compare to the location of the catchments area, percentage slope area compare to total area and erosion risk.

The slope condition can be delivered using GIS applications according to the following processes.

1. **Topographic data (Contour line)**
2. **TIN generation**
3. **DEMs (Grid)**
4. **Slope generation**
5. **Slope (Grid)**
6. **Slope (Vector)**
7. **Grid to Vector Conversion**
8. **Slope class (grid)**
9. **Reclassification**
10. **Table from MS Access**

**Figure 5.3-4.** The generate process of the slope class using model builder Arcview Extension and ODBC to connect with another information from non spatial data, e.g. slope description etc. Source : (ESRI 2000)

Based on the process described in the figure 5.4.2. The results of the slope condition of the Labanan forest management unit is provide in the following table.
CHAPTER 5. THE PARTIAL IMPLEMENTATION OF THE INFORMATION SYSTEM FOR THE DETERMINATION PROCESS OF THE INITIAL TYPOLOGY OF THE FOREST MANAGEMENT UNIT

Table 5.3-1. An example table from the information system showing the information about slope class condition of the Labanan Forest Management Unit. Original Source: GIS analysis and the 20 Years Forest Management Plan document (RKPH) of Labanan 2000.

<table>
<thead>
<tr>
<th>Slope Class</th>
<th>Description (%)</th>
<th>Area (ha)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-8</td>
<td>30.301</td>
<td>36.40</td>
</tr>
<tr>
<td>B</td>
<td>8-15</td>
<td>10.913</td>
<td>13.11</td>
</tr>
<tr>
<td>C</td>
<td>15-25</td>
<td>16.279</td>
<td>19.56</td>
</tr>
<tr>
<td>D</td>
<td>25-40</td>
<td>21.101</td>
<td>25.45</td>
</tr>
<tr>
<td>E</td>
<td>&gt;40</td>
<td>4.646</td>
<td>5.58</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>83.240</td>
<td>100</td>
</tr>
</tbody>
</table>

From table 5.4.1 it shows that Labanan management unit working area has 31% or 25747 ha that are steep (D) and or very steep (E) area, out of the total area of 83.240 ha. Another additional information based on the environment evaluation report or environment management evaluation report (SEL/RPL-a or RPL-b/EIA), it indicates that the erosion rate of the forest management unit of Labanan is very high. This information is indicated in table 5.4.-1.

Table 5.3-2. An Example from document analysis process (1.1b., see figure 4.2-1) showing the information about actual erosion rate during the period of the forest management activity. Original Source: (Muti Agung Lestari Ltd 2000)

<table>
<thead>
<tr>
<th>Erosion Rate</th>
<th>Location (by sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.68 – 15.95 ton/ha/year</td>
<td>Virgin Forest (RKL VI, VII)</td>
</tr>
<tr>
<td>281.41 ton/ha/year</td>
<td>Ex. Logging Area (RKL IV)</td>
</tr>
<tr>
<td>553.14 ton/ha/year</td>
<td>Ex. Logging Area (RKL II)</td>
</tr>
<tr>
<td>1479.53 ton/ha/year</td>
<td>Ex. Skidding Road (RKL IV)</td>
</tr>
</tbody>
</table>

The additional information shows that in the erosion rate of the Labanan working area is very high. This happen because geographically the labanan working area has a climate type A (Schmidt and Ferguson) which indicates this type has the highest level of rainfall in per year (2500 – 3000 mm/year).

The Land system condition of labanan is dominated by Hillrocky plain over sandstone (26%) and Non-oriented, high ranged hills over sandstone/mudstone (28%). The complete information about the Land system condition of Labanan forest management unit is shown in table 5.4.3. The table is generated from GIS analysis from the Land system map of Berau. The description of the land system indicates soil and geomorphologic conditions.
Table 5.3-3. An example summary table from land system map showing information about the land system of the Labanan forest management unit. Original Source: adopted from The 20 years management plan document (RKPH) of Labanan 2000 and the Soil Survey Reports of BFMP 2000. The code name of the land system map refer to the RePProT description (The Regional Planning Program for Transmigration)

<table>
<thead>
<tr>
<th>No</th>
<th>Land System</th>
<th>Description</th>
<th>Area (ha)</th>
<th>%</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LWW</td>
<td>Undulating to rolling plain over sandstone</td>
<td>6.615</td>
<td>7.95</td>
<td>Podsolik Haplik</td>
</tr>
<tr>
<td>2</td>
<td>BKN</td>
<td>Minor alluvial valley floors</td>
<td>1.243</td>
<td>1.49</td>
<td>Kambisol Fluvik</td>
</tr>
<tr>
<td>3</td>
<td>TWH</td>
<td>Hill-rocky plain over sandstone</td>
<td>22.058</td>
<td>26.50</td>
<td>Podsolik Haplik Alluvial Distrik</td>
</tr>
<tr>
<td>4</td>
<td>KPR</td>
<td>Undulating karstic plain with humus</td>
<td>17.246</td>
<td>20.72</td>
<td>Kambisol Eutrik Vertisol Kromik Vertisol Gleik Kambisol Eutrik</td>
</tr>
<tr>
<td>5</td>
<td>MPT</td>
<td>Non-oriented, high ranged hills over sandstone/mudstone</td>
<td>19.856</td>
<td>23.85</td>
<td>Oxisol Haplik Podsolik Haplik Kambisol Eutrik</td>
</tr>
<tr>
<td>6</td>
<td>MPTM</td>
<td>Non-oriented, high ranged steep sided hills Over metamorphic rock (schist)</td>
<td>9.906</td>
<td>11.90</td>
<td>Oxisol Haplik Regosol Distrik Podsolik Haplik</td>
</tr>
<tr>
<td>7</td>
<td>MPTS</td>
<td>Non-oriented, high ranged steep sided hills Over sandstone/mudstone</td>
<td>787</td>
<td>0.95</td>
<td>Oxisol Haplik Podsolik Haplik Kambisol Eutrik</td>
</tr>
<tr>
<td>8</td>
<td>GBJ</td>
<td>Hill-rocky karstic plain</td>
<td>5.529</td>
<td>6.64</td>
<td>Vertisol Leptik Litik Kambisol</td>
</tr>
<tr>
<td>9</td>
<td>TWB</td>
<td>Steep parallel, narrow crested ridges over Conglomerate</td>
<td>0</td>
<td>0.00</td>
<td>Kambisol Eutrik Podsolik Haplik</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>83.240</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

The physical environment macro condition can be reflected from the location of the Labanan forest management unit compare to the catchments area. The Labanan forest management unit is located in one catchments area (DAS) and four sub catchments area (sub DAS). The maps showing the location of the Labanan forest management unit within catchments area is indicated in figure 5.4-3.

Figure 5.3-5. An Example map from the information system showing the location of Labanan forest management unit within catchments or sub catchments area. Source: GIS analysis

Based on information about the slope condition, erosion condition, land system condition and location of the forest management unit within catchments area. It indicates that the macro physical condition of the Labanan forest management unit is categorized into “not safe” condition.
5.4. The Social Conditions of the Forest Management Unit

The Social condition of the forest management unit is influenced by four factors, i.e. the production technique, utilization zone, population density and its production motive. These factors has been discussed in chapter 3, section 3.2 sub section B (description of figure 3.2-1 and 3.2-2).

The information about the production technique, utilization zone, population density and its production motive, originally is coming from the process no 1.1b. document analysis (see figure 4.2-1), however after the analysis all of the information can be entered and stored into database. The information can be extracted from database in using SQL. An example of SQL statement is shown in the following paragraph and the output from the SQL statements is indicated in figure 5.5-1.

```
FROM (Needs INNER JOIN socio-economic ON Needs.Pop_Type_ID = socio-economic.Pop_Type_ID) INNER JOIN Desa ON socio-economic.DESA_ID = Desa.DESA_ID
ORDER BY [socio-economic].[Utilization_Zone_Area]/([socio-economic].[FamilyNumber]*[standard family needs],[needs]);
```

Figure 5.4-1. An example output from the database using SQL statements above. The information indicates the social conditions of the labanan forest management unit. Original Source: (Mutu Agung Lestari Ltd 2000). Ds. Is abbreviation from Desa = Village, SP-xx is abbreviation from Satuan Unit Pemukiman Transmigrasi= Settlement Unit, Ratio_Pop_Den = ratio of the population density

To calculate the population density, the data needs are total population or family number per village, the standards needs of life per family and the utilization zone total per each village, for example take an example of Ds. Tepian Buah, the column Utilization_zone_area is 460 and column of family_number is 31, according to the standard needs of family because this population type in Ds. Tepian Buah is local
indigenous people so the standard needs for their life is 8 ha. Therefore the ratio of the population density is \((31 \times 8)/460\) which equals to 1.8 (Mutu Agung Lestari Ltd 2000).

Then the output of query table can be combined with spatial data in the GIS to enhance the analysis of the social conditions using spatial aspect.

**Figure 5.4-2.** An Example Join Column from non spatial database (MS Access) with spatial database using ODBC interface in Arcview 3.2a. The join column aims to enhance the analysis with spatial data.

The analysis of social condition in GIS software will be helpful with support remote sensing data, especially to analyze the accessibility to the forest management unit and identify other man made features that indicates the human activities that influence the social condition of the forest management conditions. The road and the river is facility of that can be use for accessibility analysis. The data for accessibility analysis is based on road and the river (updated layer using remote sensing data). The accessibility analysis can be model to show the spatial model of an area that are risk for encroachments. The diagram model for accessibility analysis is shown in figure 5.5-4 and the results map is shown in figure 5.5-4.
Figure 5.4-3. An example analysis of the social conditions with help of the remote sensing data to identify new feature or change because human activities in the forest management unit.

Figure 5.4-4. The process of analysis the risk area for encroachment and fire (the detail process of the process no 1.2.21. that indicated in figure 4.2-3). The risk area for encroachments and fire can be used as a source information to identify the accessibility to the working area of the forest management unit. This information can enhance the information about the utilization area (see the definition about the utilization zone in chapter 3 section 3.2 sub section B)
CHAPTER 5. THE PARTIAL IMPLEMENTATION OF THE INFORMATION SYSTEM FOR THE DETERMINATION PROCESS OF THE INITIAL TYPOLOGY OF THE FOREST MANAGEMENT UNIT

Figure 5.4-5. An example map from the information system showing the social condition of the Labanan forest management unit. Source: GIS analysis

The map gives information about the location of the villages and the information of the accessibility to the forest management unit working area. Based on the analysis of the possible utilization area inside the labanan forest management unit, it indicates the accessibility of the Labanan forest management unit is very easy to reach using main road and the main river.

The information about the social condition according to LEI SNFPM certification system is based on four factors, i.e. the production technique, utilization zone, population density and production motive. Using table attributes that has been joined with spatial table attributes of the villages as the map shown in figure 5.5-5, then the identification of each factor can be described as follows

LEGEND

Forest Area Management Plan
- RKL 1 LABANAN
- RKL 2 LABANAN
- RKL 3 LABANAN
- RKL 4 LABANAN
- RKL 5 LABANAN
- RKL 6 LABANAN
- RKL 7 LABANAN

Public Road
New Public Road (Updated Road from Landsat ETM 2005)
Logging Road
Labanan FMU boundary
Village
Risk Area
One risk area
Inreachment risk area

Original Source:
Working Plan Map of Labanan at scale 1:100000
Road Network Map of Labanan at scale 1:100000
Production Type

Summary Village per Production Technique

![Production Type Chart]

Figure 5.4-6. An Example Graphical Chart Showing Summary Village Per Production Type (refer to table 3.2-11)

Based on production technique prescribed by LEI SNFPM Scheme. The social communities of the village surrounding the Labanan forest management unit have two type of production technique i.e. Intensive farming and rotation farming (see the detail in figure 5.5-1). The Intensive farming usually is conducted by the settler local community and the rotation farming usually is conducted by the local ethnic community (Mutu Agung Lestari Ltd 2000).

Utilization Zone

Summary Village per Utilization Zone

![Utilization Zone Chart]

Figure 5.4-7. An example graphical chart showing summary village per utilization zone. (refer to table 3.2-11)

Based on the utilization type it can be identified that there are two settlements is inside within the FMU area which is the transmigration area and 13 villages others are outside the FMU area (see complete information in figure 5.5-1and figure 5.5-5, the code settlement is SP-xx ). However based on field verification the assessor found that there are some small settlement areas that are sparsely distributed within FMU area e.g. people from Sидунг village in Km 20 main road to Ds. Тепиан Буах. (Mutu Agung Lestari Ltd 2000). However the indication of the existing of settlements inside the forest management unit area or its utilization zone can be identified using remote sensing data as an example in figure 5.5.3, using Landsat TM 2000 image the settlements and
its utilization area can be detected. This proven that the remote sensing data is useful to quickly identify the recent condition.

**Population Density**

![Graph showing population density](image)

Figure 5.4-8. An example graphical chart showing summary village per population density

In general the population density is different between indigenous local community and settler local community. While for the indigenous because of their culture influence the way of living by applying rotation farming therefore they need 6 ha to 10 ha of the utilization zone and settler local community mostly dominant by transmigration people they apply intensive farming, so they need only 2 ha for the utilization zone. The information shows that 8 villages has high population density, 1 village is ideal situation while 4 others is low density that is dominantly by transmigration area. However because of distance of villages with high population density then the expert panel I and assessor team concluded that in general the utilization zone of Labanan is low. (Mutu Agung Lestari Ltd 2000).

**Production Motive**

![Graph showing production motive](image)

Figure 5.4-9. An example summary village per production motive

Based on summary information of the social condition of Labanan has 5 villages with commercial production motive and 7 others are subsistent. For the indigenous local community in general the motive is subsistent while for the settler community is commercial. However the expert panel I and assessor team concluded that the production motive in general is subsistent, the other village that has a commercial motive are the villages that have an intensive farming system therefore it is considered
will not disturb the forest management unit and its forest area (Mutu Agung Lestari Ltd 2000).

**Summary Social Condition**

In summary the social condition based on the information of four factors that influence the management unit activity, based on combination matrix of that four factors as provide in Table 3.2-11., the sensitivity scale is 17 then the Initial social typology is 01 it means that social condition is not a major problem or it is not considered as a priority in the planning and management. However because of the head of district government issued the regulation No 590/08/T.PEM.A/1999 about 100 ha small forest concession. This regulation permits the local communities or other communities to have small concession area (100ha), because of this the Labanan forest management condition has become vulnerable because the people may have right to claim some of area within forest management unit. Therefore the expert panel I and assessor team concluded that the initial typology of the forest management unit based on social condition is 02 (Mutu Agung Lestari Ltd 2000).

### 5.5. General Condition of Forest Management Unit (ecology/environment and social)

The conclusion of initial typology of the forest management activity based on production aspect is influenced by the ecological and social condition. Therefore based on ecological condition that is defined by the forest fragmentation condition which is semi fragmented (02) and the location (geographical properties) of the environment of the forest management unit which is “not safe” or 02. Then according to table 3.2-6 then the sensitivity value is 02. Consider that the social condition has a sensitivity value 02 then based on table cross combination between ecological and social condition (table 3.2-13), the typology of forest management unit is 04 which is categorized in “safe condition”. This conditions indicates that the forest management unit should be able to implements the forest management in a good performance in the output (Mutu Agung Lestari Ltd 2000). However the information and its description about the ecological and social condition will be use as a reference information for reasoning judgments when defining the standard acceptable value for each indicators in the performance evaluation in the next process (see figure 3.2-1).

### 5.6. Conclusion

The partial implementation has shown that the information system can provide the information needs as requirements prescribed by the model. Remote Sensing data may be useful to deliver recent development of last forest condition and its surrounding and GIS applications are useful to deliver the information by applying some GIS functions (querying, overlay etc.). Therefore Remote Sensing and GIS tools can support the typology assessment process, and the information can be provide in many ways (ESRI). However for the determination of the initial typology of the forest management unit, the limitation of the developed information system is for the determination of the Initial typology is valid when there are no other additional information that influence the Initial typology as Labanan case study and LEI SNFPM information requirements.

The determination of the final typology of the forest management unit, LEI SNFPM scheme prescribed that another additional information about other influence factors are needed as prescribed in chapter 3, section 3.2 sub section C. The determination of the final typology of the forest management unit is more on the basis human judgments of Expert Panel II with the additional information based on field verification activity and current development that influence the typology of forest management unit like i.e.
district government regulation, social reformation etc (Lembaga Ekolabel Indonesia 2000a).
CHAPTER 6.

DISCUSSION AND CONCLUSION

6.1. General Discussion

The Sustainable Natural Forest Production Management Certification System is a tool for evaluation of the Natural Forest Production Management System of the forest management unit. The essence of the SNFPM certification is auditing process, the auditing process will verify and confirm the information that coming out from the forest management activities. As an evaluation tool, the SNFPM certification system use a standard so the evaluation results is comparable. One of the standard that use in the SNFPM certification system is the typology of the forest management unit. The aims to use the typology of the forest management unit is to minimize the bias of evaluation because of the weighted factors that caused by ecological and social conditions. The requirements of the information about the ecological and social condition can be modeled and implemented into the information system that incorporate the remote sensing and GIS technology. The partial implementation process shows that the process to acquired the information about ecological and social conditions can be supported by remote sensing data and GIS. The implementation of the model for the determination process of the initial typology of the forest management unit shows that remote sensing and GIS can support this process by provided the updated information from the remote sensing data and improving the information quality and its visualization using GIS analysis process. When implementing the model for the determination process of the typology of the forest management because it use the data from the forest management unit is to understand the data model and its semantics meaning. This problems occurs frequently during the development of the GIS information system when the data and information are coming from another GIS information system, because the development process of each GIS information system is very often based on its application background of the developers (Bennet 1997; Abel, Ooi et al. 1998). The Labanan case study is an example, because the GIS data and information that developed in Labanan aims to support the projects which involves various parties and organization, surely the GIS data and information has different semantic meaning from the usual semantics that is usually use for the forestry domain in Indonesia (ministry of forestry / INTAG standard), for example the vegetation data is different semantic compare to INTAG standard. However this problem can be solved if the documentation of the GIS information and its data are available.

6.2. Conclusion and Recommendation

The SNFPM certification system apply the local standard called the typology of the forest management unit beside the unique standard for each indicators. The typology of the forest management unit is defined by the ecological and social conditions
locally. The typology of the forest management unit in practice can be categorized in two type, *i.e.* the Initial typology of the FMU which determined during pre-field evaluation process and the final typology of the FMU after field assessment process. The processes of the determination of the initial typology of the forest management unit can be modelled. The partial implementation has shown that remote sensing and GIS technology can provide the information needs as requirements prescribed by the model. The improvements of the determination processes are improve the delivery process of information from manual to automated process, improve the visualization of the information, enhanced the information quality with help of the remote sensing image analysis.

The processes of the determination of the final typology of the forest management unit is based on the additional information of the social factors as discussed in chapter 3. section 3.2, part C. The determination is more on the basis of human judgment of the expert panel.

However for the further research it is suggested the use of multi criteria analysis can be incorporated as a functional part of the model. The multi criteria implementation as DSS is an alternative to improve the information processing for the determination of the typology of the forest management unit. However the investigation what kind of multi criteria and its methodology for the determination process requires further research investigation in application domain because this believe is going to change some part of the requirements of the typology of the forest management unit.
REFERENCES


BFMP (1999). Analysis of Secondary Data from Villages in or Close to Swakelola Labanan, PT Inhutani I. Berau, DHV consultant in association with Tropenbos, Deutsche Forst Consult, Arcotech, Jaakko Poyry, PT Mitra Lingkungan, BFMP-Inhutani I


Fakultas Kehutanan UGM (2000). Penyusunan Ulang RKPH Unit Manajemen PT Inhutani I Labanan, PT Inhutani I


Mutu Agung Lestarri Ltd (2000). Laporan Penilaian Lapangan Sertifikasi PHPL Unit Labanan PT Inhutani I, Mutu Agung Lestarri Ltd,
Appendix 1. List of Question for Interview
The purpose of the question is just to make confirmation and clarification about the LEI SNFPM certification system, because all of the information about SNFPM certification system are in the LEI Document Guideline 99 Series (see appendix 12)

Question Addressed to Forest Management Unit
- Sustainable Forest Management in Concession Opinion, what is it?
- How is the Sustainable Forest Management Implements in practice?
- What is the routine activity of the Forest Management System in Labanan?
- How is the Forest Management in Labanan implements in practice?
- What kind of information needs for forest management activity in Labanan
- Could you explained about the routine forest management activities and what kind of data or information needs for supporting the routine forest management activities
- What is your opinion about forest certification?
- In your Opinion where is the simple certification system? LEI system or FSC system? Would please explain more why?

Question Addressed to Other Stakeholders
- Question no 1
- Question no 7
- Question no 8
- In your opinion what is the future prospect of forest certification
- How do you think the forest management Implementation in Indonesia

Question Addressed to LEI, Assessor Team and Expert Panel
- What is the purpose of the forest certification?
- How is the forest certification works in practice?
- I Have read the LEI SNFPM Guideline 99 series. Could you elaborate more clearly what is typology and why does it use for certification?
- How is the relation between typology and decision making process?
- What kind of information or data needs to determine the typology of FMU? How much the detail level?
- In your opinion so far why you are using manual method rather than using the computer based processing?

Beside the question list, during the fieldwork some document also collected especially document about training activity of Expert Panel.
Summary the interest of Actors, Clients and Other Stakeholders

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Role in SNFPM</th>
<th>Expected Information/Data provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concession (HPH) Forest Management Unit</td>
<td>As a Client which applied a certain management type for forest resources. Is it sustainable manner or not To have a more buyer/consumers from their products because of eco-label certification</td>
<td>Decision information (pass or fail) and recommendation on which indicator/part that concession (HPH) should be improved Provide all data and information related Forest Resources and their Management</td>
</tr>
<tr>
<td>Case: Labanan FMU of Inhutani I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessor (Certifier body)</td>
<td>Implement the SNFPM system by conducting field assessment process after scoping process done by expert panel. Assessment include field assessment and verifier/indicator assessment</td>
<td>All information about Forest Resources in current concession (HPH) and their management include social condition surrounding forest Provide report on Assessment process include information on Verifier/Indicator and Typology Information</td>
</tr>
<tr>
<td>Case: Mutu Agung Lestari Jaya</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Maker (expert panel)</td>
<td>Conduct pre-scooping for a certain FMU to make decision in early stage in certification process Assess, give valuation and make final decision <em>(accessible fair, transparent and clear)</em> on a certain FMU based on information from Assessor Make final recommendation when they have make a decision</td>
<td>All information about forest resource condition, what is their forest management type for manage the forest resource, how is the impact on forest resources it self.</td>
</tr>
<tr>
<td>Ad Hoc Panel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEI</td>
<td>Facilitate the stakeholders forum, develop the certification system testing and implement the eco-label certification system Give right/certify to certification body to implement and executing the certification system Evaluate the system and give an improvement</td>
<td>Information on Concession (HPH) that has applied Sustainable Forest Management How the system/process is going on. Is it needs to be re-evaluated.</td>
</tr>
<tr>
<td>Source: Literature Study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2. The SNPFM Indicators Development Matrix

<table>
<thead>
<tr>
<th>MANAGEMENT DIMENSION</th>
<th>OUTPUT DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sustainability of Production Function</td>
</tr>
<tr>
<td></td>
<td>Sustainable forest resources</td>
</tr>
<tr>
<td>1. Area Management</td>
<td>Indicators</td>
</tr>
<tr>
<td>1.1 Area Stabilisation</td>
<td>Indicators</td>
</tr>
<tr>
<td>1.2 Area Arrangement</td>
<td>Indicators</td>
</tr>
<tr>
<td>1.3 Area Security</td>
<td>Indicators</td>
</tr>
<tr>
<td>2. Forest Management</td>
<td>Indicators</td>
</tr>
<tr>
<td>2.1 Production</td>
<td>Indicators</td>
</tr>
<tr>
<td>management</td>
<td>Indicators</td>
</tr>
<tr>
<td>2.2 Environmental</td>
<td>Indicators</td>
</tr>
<tr>
<td>management</td>
<td>Indicators</td>
</tr>
<tr>
<td>2.3 Social management</td>
<td>Indicators</td>
</tr>
<tr>
<td>3. Institutional</td>
<td>Indicators</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Indicators</td>
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<td>3.1 Organization</td>
<td>Indicators</td>
</tr>
<tr>
<td>3.2 Human Resources</td>
<td>Indicators</td>
</tr>
<tr>
<td>3.3 Financial</td>
<td>Indicators</td>
</tr>
<tr>
<td>management</td>
<td>Indicators</td>
</tr>
</tbody>
</table>

Notes:  
- Prerequisite  
- Core of forest management activity  
- Supporting management

Source: (LEI, 2000a)
### Appendix 3. Field Data Collection from Labanan, Forest Management Unit of Inhutani I

<table>
<thead>
<tr>
<th>Data Name</th>
<th>Data Type</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite Image</td>
<td>Digital Erdas LAN format</td>
<td>Yes</td>
</tr>
<tr>
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Appendix 4. Forest Management Model with ISO14001 implementation in Inhutani I, Labanan Management Unit

Source: Labanan, Inhutani I
(From fieldwork activity)
Appendix 5. Organization Structure Of Forest Management Unit (Some Case Study)
Labanan Forest Management Unit of Inhutani I Organization Structure, with ISO14001 Implementation.

CEO = Chief Executive Organization
ISO = International Standard Organization
ISO14001 = Environmental Management System (see http://www.iso.org for detail information)

Source : Labanan Forest Management Unit of Inhutani I
(From fieldwork activity)
Appendix 6. Organization Structure Of Forest Management Unit (Some Case Study)
Organization Structure which is mostly appears within all of Forest Management Unit for Natural Forest Production Management System.

Source:
Meeting and visiting guest to Inhutani I and Barito Pasicic Timber.
Interviewing ex. Expert Panel Members and person who has followed the training for become expert panel.
Discussion with forestry practitioners and lecturer staff from Gadjah Mada University.
Planning for Sustainable Forest Management (10 Years period)/ RPKH 1995 report of Ngawi Administratur (FMU level) of Perhutani Unit I Central Java
Appendix 6. Brief Function Description Of Forest Management Unit Department And Division

Forest Manager:
1. Planning coordinating, controlling and monitoring all operation activity for the area that under his/her supervisor.
2. Design operational plan all activity based on annual planning (RKT)
3. Planning and responsible for Financial Budgeting based on operational plan
4. Report montly, quarterly, semester and yearly and make an evaluation of it.
5. Conducting the instruction from main / central office regulation

Accounting and Finance:
1. Planning coordinating, controlling and monitoring the financial / cost for every activity
2. Design and allocate financial for the operational based on annual planning budget plan
3. Coordinating with accounting and financial department in main/central office
4. Report frequently (month, quarter, semester and yearly) to Forest Manager

Personal and Administration
1. Planning coordinating, controlling and monitoring the personal performance for each department
2. Design and allocate personal needs for the operational based on annual planning (RKT)
3. Evaluate the personal performance and give recommendation for promotion for the personal to forest manager
4. Report frequently (month, quarter, semester and yearly) to Forest Manager
5. Administrative function: record, mail, letter, distribute every information coming out and in.
6. Coordinating with personal and Administration department in main/central office
7. Planning and Coordinating for public and law affair
8. Planning and conducting training to improve the personal capacity and capability

Marketing
1. Planning coordinating, controlling and monitoring all every stocks in forest and in Log ponds and every logs that has been transport and sell
2. Design and allocate the market projection based on annual planning (RKT)
3. Evaluate the marketing situation and coordinate with main/central office
4. Report frequently (month, quarter, semester and yearly) to Forest Manager
5. Coordinate with Production Department to achieve the target.
**Data Management and Documentation**

1. Collecting and manage the data from various sources to support other department and activity.
2. Analyse data and provide to management unit level for decision making process
3. Receive updated data from other department and responsible to update the data
4. Responsible to distribute the information needs for every department as their functionality

**Forest Planning**

1. Planning coordinating, controlling and monitoring planning activity
2. Design the operational plan for planning based on annual plan (RKT)
3. Collecting information based on terrestrial measurement (surveying and mapping)
4. Collecting forest information characteristics (Forest Inventory)
5. Establishing and maintain the forest management unit boundary
6. Planning allocate and scheduling field activity including the equipment (surveying and mapping and forest inventory)
7. Report frequently (month, quarter, semester and yearly) to Forest Manager

**Forest Production**

1. Planning coordinating, controlling and monitoring production activity
2. Monitor and control the production activity
3. Responsible to cut logs and transport it until log pond area / stock area
4. Responsible for Logs administration system
5. Coordinate with Planning Department and other dept
6. Planning, allocate and scheduling the equipment use and its productivity
7. Report frequently (month, quarter, semester and yearly) to Forest Manager

**Post Production Dept**

1. Planning coordinating, controlling and monitoring post production activity
2. Responsible to conducting area re-arrangement after logging
3. Collecting information based on terrestrial measurement (surveying and mapping) after production activity
4. Collecting forest information characteristics (Forest Inventory) after production activity
5. Establishing the permanent Inventory plot, Plasma Nutfah (biodiversity), and other plot for research purpose and maintain it and conduct frequently data collection from it
6. Report frequently (month, quarter, semester and yearly) to Forest Manager

**Social Dept.**
1. Planning coordinating, controlling and monitoring post production activity
2. Design operational plan for social activity based on annual plan
3. Conducting social activity by cooperation, and other activities in village surrounding forest management unit
4. Responsible to minimize the effect of social conflict by conducting approach to the community
5. Report frequently (month, quarter, semester and yearly) to Forest Manager

**Technical and Support Dept.**
1. Planning coordinating, controlling and monitoring all the technical equipment and tools that support the activity
2. Design and allocate the equipment and tools based on annual planning (RKT)
3. Responsible for maintenance the equipment and tools
4. Responsible for providing the spare-part of equipment and tools
5. Report frequently (month, quarter, semester and yearly) to Forest Manager.

Source: 20 years Planning for Forest Management Unit / RKPH
Appendix 7. Rich Picture Diagram of Forest Management Information flow within forest management unit

source: 20 years planning / RKPH, analysis of organization structure and function
## Appendix 8. Information Collection about LEI SNFPM certification system

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Data type</th>
<th>Availability and Restriction</th>
<th>Source</th>
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<td>LEI document 99 Criteria and Indicator Information needs for Verifier level</td>
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<td>Interview data based on meeting Interview based on meeting Expert Panel recommendation report</td>
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<td>Mutu Agung Certifier under agreement with Inhutani1, Staff of Faculty of Forestry Gadjah Mada University</td>
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Appendix 9. Procedure To Understand SNFPM Certification System

LEI SNFPM Certification System

Academic Document of SNFPM certification system

Understanding about background, logical framework, the use of AHP as decision tools, certification process and system development of certification

Document Standard LEI 5000

Understanding about framework of system, principles, criteria, indicators, requirements, activity, actors and its terminology

Guideline 99

Understanding about system implementation, process certification, field assessments, typology definition, procedure, and decision making process

Technical Document LEI-01

Understanding about Criteria, Indicator and verifiers and data needs for assessments

Technical Document LEI-01

Understanding Intensity Scale of UIM performance in each indicators

source: Agung and Hinrich (2000)
Appendix 10. Basic Forestry Document and FMU Basic Data (Information needs Analysis)
Source: LEI Document 99 Chapter Scoping Guideline
Document that needs to submit by the concession / forest management unit when applying for certification is shown below:
1. Corporate Statement Document which signed by Forest Manager of FMU the statement should contain following information:
2. Information about FMU:
3. Basic Legal aspect of the forest company
4. Legal Letter about Forest license / agreement from government or the extended agreement
5. Address of Main / Central Office, Office representative and Base Camp
6. Owner / Shareholders and how much they shared for FMU
7. Organizational of the Company from CEO until Camp manager
8. General Information about Forest Resources:
9. Area, location and forest type of FMU
10. History of Forest Management Activity
11. Forest condition change, until present which because of forest management activity or others

General Information about Ecological / Environment aspect of FMU
1. Location of FMU within regional context, position (geographical properties) with other forest area, conservation area, protected area, other area and location within catchments area
2. Condition of ecology type, physical or biotic within FMU which is considered in management aspect.
3. Ecological change which occurs and influenced during forest management activities

General Information about Social condition
1. Location of FMU within administrative government and location of FMU from settlements (inside or outside or even surrounding).
2. Specific condition which is considered in management
3. Human Resources of FMU for carried out the activities.

Vision, Mission and Objective of FMU to carried out forest management practice, given the existing specific ecological and social condition.

Document of Forest Management Unit
1. Copy of Forestry Agreements (SK) about forestry license or extended license
2. Copy of Letter of Company Agreement (Company treaty / Act)
3. Landsat Image (hardcopy/digital) and or aerial photo with sufficient scale.
4. Landsat Image or aerial photo Interpretation (maps)
5. Feasibility Document or any kind of

Planning Document
1. 20 years forest management plan document (RKPH) within current period
2. 5 years forest management plan document (RKL) within current RKPH operational period
3. 1 years forest management plan document (RKT) within current RKL operational period
4. Environment Management Plan (RPL)
5. Environment Monitoring Plan (RPL)
6. Plan for Social activity
7. Financial plan
8. Operational plan

Report Document within at least 3 years old
  1. Recapitulation of Timber cruising report (LHC)
  2. Recapitulation of Production Report (LHP)
  3. Recapitulation of Logs transportation (LMKB)
  4. Boundary Establishment report for all transect in Boundary of FMU
  5. Silviculture activity Report
  6. Silviculture auditing activity Report
  7. Environment Management Implementation Report
  8. Environment Monitoring Implementation Report
  9. Social Management Implementation report
 10. Permanent Inventory Plot (PIP) Report
 11. Marketing report
 12. Financial report
 13. Tax Report
 14. Report or proven participation on social development
 15. Social conflict report
 16. Others Document that relevant and supporting the FMU performance

Beside all data and document listed, FMU is obligated to provide additional information as information need by Expert Panel.
Appendix 11. The Complete Model of Modular Design (Sub System) for the Process no 1.2. The determination of the typology of the forest management unit. This sub process is the improvement model of the model indicates in the figure 3.3-1, 3.3-2, 3.3-3, 3.3-4. The model includes the functionality and task description for the Information system using GIS and database functionality

Process: 1.2.1.1 Degree of Habitat Fragmentation

Process: 1.2.1.2.1 Environmental Physical Condition

Process: 1.2.1.2.2. Biological Condition of FMU
Process : 1.2.1.2.3. Determination of Location condition (geographical properties) of FMU

1.2.1.2.3. Determination of the location condition (geographical properties) of FMU

Biological sensitive info

Physical sensitive info

Sensitivity value of Location (geographical properties) of FMU

Views : (none)
View Analysis : (none)
Conceptual decision:
if Physical environment sensitive info is Safe and Biological Sensitive info is Safe then "value=01" Else if Physical environment sensitive info is Not safe and Biological Sensitive info is Safe or Physical environment sensitive info is Safe and Biological Sensitive info is not safe then "value=02" Else "value=03"

Process : 1.2.1.3. The Determination of Typology of the forest management unit based on Environment / Ecological Condition

1.2.1.3. Determination of the typology of the forest management unit based on ecological condition

Sensitivity value of Typology Environment/Ecology

Sensitivity value of Habitat fragmentation

Sensitivity value of Location properties of FMU

standard for typology ecology/environment

Views : (none)
View Analysis : (none)
Conceptual decision:
if Locational properties value = 01 and sensitivity value of habitat fragmentation = 01 then the typology ecology value = 01 Else if Locational properties value = 01 and sensitivity value of habitat fragmentation = 02 Or Locational properties value = 02 and sensitivity value of habitat fragmentation = 01 Then Typology ecology value=02 Else Typology ecology value=03
The improvement Model of The process 1.2.2. The determination of initial typology of the forest management unit based on the social condition.

The detail process of the process no 1.2.2. The determination of initial typology of the forest management based on the social condition. This process is the detail level the process no 1.2. of figure 3.3-1 and this process is the third level diagram from the process no. 1 of the process indicated in the diagram of figure 2.2-3.

**Gane-Sarson Data Flow Diagram**

**Process : 1.2.2.1. Utilization area analysis (spatial)**

- RS Data
- village
- 1.2.2.1. utilization area analysis (spatial)
- location of the utilization area

**Process : 1.2.2.2. Social Environment Condition**

- Utilization Zone
- production technique
- population density
- production motive
- Sensitivity value of Social Typology (Initial)

Decision Analysis is based on table sensitivity for social activity of Forest Management in Indonesia:

- Clustering Decision Analysis
  - if Social >= 2 AND Social <= 18 then Social Typology = 01 Else if Social = 19 AND Social <= 36 then Social Typology = 02 Else if Social=37 AND Social <= 54 then Social Typology = 03 Else Social Typology = 04

Analysis and Query
- Display Query: Production technique per village
- Utilization zone = SHAPE: Query: Area (ha) per village
- population density = query from population Table: Utilization Zone (family number / area ha per family)
- production motive = Display query: production motive per village

Views :
- Village Location
- RS Data
- Accessibility to FMU: FMU Boundary, Road Network

Analysis and Query
- Visually analyze the accessibility of to the FMU based on accessibility
- Identify the utilization zone area with help of RS data

Sensitivity value of initial social conditions
Process: 1.2.3. The Determination of The initial typology of the forest management unit based on Ecological and Social condition

The determination of initial typology of the forest management unit is a combination of Environment / Ecology and Social Sensitivity value.
Appendix 12. Brief Documentation Of Sustainable Natural Forest Production Management Certification System

I. Document type and Status
Document type and status document from every LEI standard and guideline is written in the cover page as follows:

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<th>Document type</th>
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<td>Date</td>
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A. Document type
Proposed Document is new document that proposed for completing system certification document
Amendment is result document from the revision process from the previous document that has been fixed become Guideline

B. Document Status
LEI-I is a proposed document that has been proposed by the LEI secretariat
LEI-II is a proposed document/amendment result based on first meeting and or consultation process with the stakeholders
LEI-III is a proposed document/amendment result based on small group work formed by LEI
LEI-IV is a proposed document/amendment result based on second meeting and or consultation process with the stakeholders
LEI-V is a proposed final document that proposed by LEI to be approved by stakeholders
Document final is a document that has been approved by the chairman of LEI foundation

C. Document numbering
Document numbering is not independent but is connected with other document type and status. For example **No document LEI-II/99-02/2**, explain that the document is published based on first meeting with serial number 99-02 and is a second draft from its previous the document status.

D. Date of Document
Indicate the date of document published

II. Document Title
Document title use LEI numbering system, for example: LEI Guideline 99-01 : General criteria of Certification body of SNFPM
### III. Numbering System

#### LEI Standard Document

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<td>Framework of Sustainable Natural Forest Management System</td>
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<td>Standard LEI 5000-1</td>
<td>Sustainable Natural Forest Production Management System</td>
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<td>Standard LEI 5000-2</td>
<td>Sustainable Plantation Forest Management System</td>
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<td>Standard LEI 5000-3</td>
<td>Sustainable Community Based Forest Management System</td>
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<td>1 Standard LEI 5000-4</td>
<td>Sustainable Non-wood Forest Production Management System</td>
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<td>2 Standard LEI 5001</td>
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<td>3 Standard LEI 5002</td>
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#### Guideline LEI 55

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#### Guideline LEI 88

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<td>Chain of Custody Certification System</td>
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<tr>
<td>2 Guideline LEI 88-00</td>
<td>Guideline for Criteria and Procedure of Chain of Custody work</td>
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<td>General Criteria of Field Assessor of Chain of Custody</td>
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<td>General Criteria of Expert Panel of Chain of Custody</td>
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<td>General Criteria and Procedure of Training for Chain of Custody Certification</td>
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<td>4 Guideline LEI 88-20</td>
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<td>Guideline for Define Recommendation of Chain of Custody</td>
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### Technical Document LEI

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### Academic Document LEI

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Appendix 13. The Database Schema DLL Script Language
-- This SQL DDL script was generated by Visio Enterprise (Release Date: LOCAL BUILD).

-- Driver Used : Visio Enterprise - Microsoft Access Driver.
-- Document : C:\Mijn documenten\mijn thesis\visio DFD\er logical model.vsd.
-- Time Created: January 28, 2002 12:33 PM.
-- Operation : From Visio Generate Wizard.
-- Connected data source : MS Access Database
-- Connected server : ACCESS
-- Connected database : C:\Mijn documenten\mijn thesis\visio DFD\Typology.mdb

-- Create new table 'Vegetation',
-- 'Vegetation' : Table of Vegetation
-- 'L_COVER' : L_COVER identifies Vegetation
-- 'L_COVER_NAME' : L_COVER_NAME is of Vegetation
-- 'DESCRIPTION' : DESCRIPTION is of Vegetation
-- 'BTSLBN_ID' : BTSLBN_ID is of Vegetation
-- 'FMU_ID' : FMU_ID is of Vegetation
create table 'Vegetation' (  
  'L_COVER' VARCHAR(255),  
  'L_COVER_NAME' VARCHAR(255),  
  'DESCRIPTION' VARCHAR(255),  
  'BTSLBN_ID' DOUBLE,  
  'FMU_ID' DOUBLE, constraint 'PrimaryKey' primary key ('L_COVER') );

-- Note: Access does not support the creation of mandatory ( not null ) constraint using SQL
-- create table construct for table 'Vegetation'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'Vegetation'.
-- 'L_COVER'

-- Create new table 'TGHK',
-- 'TGHK' : Table of TGHK
-- 'F_ID' : F_ID identifies TGHK
-- 'TGHK' : F_Class is of TGHK
-- 'Code' : Code is of TGHK
-- 'Description' : Description is of TGHK
-- 'OriginalSources' : OriginalSources is of TGHK
-- 'BTSLBN_ID' : BTSLBN_ID is of TGHK
-- 'FMU_ID' : FMU_ID is of TGHK
create table 'TGHK' (  
  'F_ID' DOUBLE,  
  'TGHK' CHAR(10),  
  'Code' VARCHAR(50),  
  'Description' VARCHAR(255),  
  'OriginalSources' VARCHAR(255),  
  'BTSLBN_ID' DOUBLE,  
  'FMU_ID' DOUBLE, constraint 'TGHK_PK' primary key ('F_ID') );

-- Note: Access does not support the creation of mandatory ( not null ) constraint using SQL
-- create table construct for table 'TGHK'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'TGHK'.
-- 'F_ID'
-- 'TGHK'

-- Create new table 'Socio-economic',
-- 'Socio-economic' : Table of Socio-economic
-- 'DESA_ID' : DESA_ID identifies socio
-- 'FamilyNumber' : FamilyNumber is of socio
-- ‘Pemukiman/Settlement’ : Pemukiman/Settlement is of socio
-- ‘Utilization_Zone_Area’ : Utilization_Zone_Area is of socio
-- ‘Pop_Type_ID’ : Pop_Type_ID partly identifies socio
-- ‘Production_technique’ : Production_technique is of socio
-- ‘Production_Motive’ : Production_Motive is of socio
create table ‘Socio-economic’ (  
    ‘DESA_ID’ DOUBLE,
    ‘FamilyNumber’ DOUBLE,
    ‘Pemukiman/Settlement’ VARCHAR(255),
    ‘Utilization_Zone_Area’ DOUBLE,
    ‘Pop_Type_ID’ DOUBLE,
    ‘Production_technique’ CHAR(50),
    ‘Production_Motive’ CHAR(10), constraint ‘PrimaryKey’ primary key (‘DESA_ID’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘Socio-economic’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘Socio-economic’.
-- ‘DESA_ID’

-- Create new table ‘Slope’.
-- ‘Slope’ : Table of Slope
-- ‘SlopeID’ : SlopeID identifies Slope
-- ‘Description’ : Description is of Slope
-- ‘SLOPE’ : SLOPE is of Slope
-- ‘BTSLBN_ID’ : BTSLBN_ID is of Slope
-- ‘FMU_ID’ : FMU_ID is of Slope
create table ‘Slope’ (  
    ‘SlopeID’ VARCHAR(255),
    ‘Description’ VARCHAR(255),
    ‘SLOPE’ VARCHAR(255),
    ‘BTSLBN_ID’ DOUBLE,
    ‘FMU_ID’ DOUBLE, constraint ‘PrimaryKey’ primary key (‘SlopeID’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘Slope’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘Slope’.
-- ‘SlopeID’
-- ‘SLOPE’

-- Create new table ‘Road’.
-- ‘Road’ : Table of Road
-- ‘Status’ : Status identifies Road
-- ‘RoadStatus’ : RoadStatus is of Road
-- ‘BTSLBN_ID’ : BTSLBN_ID is of Road
-- ‘Description’ : Description is of Road
-- ‘FMU_ID’ : FMU_ID is of Road
create table ‘Road’ (  
    ‘Status’ DOUBLE,
    ‘RoadStatus’ VARCHAR(50),
    ‘BTSLBN_ID’ DOUBLE,
    ‘Description’ VARCHAR(255),
    ‘FMU_ID’ DOUBLE, constraint ‘Road_PK’ primary key (‘Status’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘Road’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘Road’.
-- ‘Status’
-- Create new table `RKL_blok`.
-- `RKL_blok`: Table of RKL blok
-- `AREA`: AREA is of rkl
-- `RKL`: RKLID1 identifies rkl
-- `BTSLBN_ID`: BTSLBN_ID is of rkl
-- `FMU_ID`: FMU_ID is of RKL blok
create table `RKL_blok`
    (`AREA` DOUBLE,
    `RKL` VARCHAR(20),
    `BTSLBN_ID` DOUBLE,
    `FMU_ID` DOUBLE);

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table `RKL_blok`. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table `RKL_blok`.
-- `RKL`

-- Create new table `River`.
-- `River`: Table of River
-- `Riv_id`: Riv_id identifies River
-- `BTSLBN_ID`: DAS_ID is of River
-- `RiverClass`: RiverClass is of River
-- `FMU_ID`: FMU_ID is of River
create table `River`
    (`Riv_id` DOUBLE,
    `BTSLBN_ID` DOUBLE,
    `RiverClass` VARCHAR(20),
    `FMU_ID` DOUBLE, constraint `River_PK` primary key (`Riv_id`));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table `River`. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table `River`.
-- `Riv_id`

-- Create new table `Province`.
-- `Province`: Table of Province
-- `ProvinceID`: ProvinceID identifies Province
-- `Province`: Province is of Province
-- `KabupatenID`: KabupatenID is of Province
create table `Province`
    (`ProvinceID` DOUBLE,
    `Province` CHAR(20),
    `KabupatenID` DOUBLE, constraint `Province_PK` primary key (`ProvinceID`));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table `Province`. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table `Province`.
-- `ProvinceID`

-- Create new table `protected area`.
-- `protected area`: Table of protected area
-- `L_ID`: L_ID identifies Lindung
-- `ProtectName`: ProtectName is of Lindung
-- `Description`: Description is of Lindung
-- `BTSLBN_ID`: BTSLBN_ID is of Lindung
-- `ProtectClass`: ProtectClass is of Lindung
-- `FMU_ID`: FMU_ID is of protected area
create table `protected area`
    (`L_ID` DOUBLE,
‘ProtectName’ CHAR(20),
‘Description’ VARCHAR(255),
‘BTSBN_ID’ DOUBLE,
‘ProtectClass’ CHAR(10),
‘FMU_ID’ DOUBLE, constraint ‘Lindung_PK’ primary key (‘L_ID’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘protected area’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘protected area’.
-- ‘L_ID’

-- Create new table ‘Standard needs per family’.
-- ‘Standard needs per family’: Table of Standard needs per family
-- ‘PopulationType’: PopulationType is of Needs
-- ‘Needs’: NeedsID1 is of Needs
-- ‘Description’: Description is of Needs
-- ‘Pop_Type_ID’: Pop_Type_ID identifies Needs
create table ‘Standard needs per family’ (  
  ‘PopulationType’ VARCHAR(255),
  ‘Needs’ DOUBLE,
  ‘Description’ VARCHAR(255),
  ‘Pop_Type_ID’ DOUBLE, constraint ‘PrimaryKey’ primary key (‘Pop_Type_ID’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘Standard needs per family’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘Standard needs per family’.
-- ‘Pop_Type_ID’

-- Create new table ‘Land System’.
-- ‘Land System’: Table of Land System
-- ‘L_SYS’: L_SYS identifies LandSystem
-- ‘BTSBN_ID’: BTSBN_ID partly identifies LandSystem
-- ‘Erodibility’: Erodibility is of LandSystem
-- ‘Description’: Description is of LandSystem
-- ‘OriginalSource’: L_SYS_Name is of LandSystem
-- ‘FMU_ID’: FMU_ID is of Land System
create table ‘Land System’ (  
  ‘L_SYS’ CHAR(10),
  ‘BTSBN_ID’ DOUBLE,
  ‘Erodibility’ CHAR(10),
  ‘Description’ VARCHAR(255),
  ‘OriginalSource’ VARCHAR(255),
  ‘FMU_ID’ DOUBLE, constraint ‘LandSystem_PK’ primary key (‘L_SYS’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘Land System’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘Land System’.
-- ‘L_SYS’
-- ‘Erodibility’

-- Create new table ‘KPHP’.
-- ‘KPHP’: Table of KPHP
-- ‘KPHP’: KPHP identifies KPHP
-- ‘Description’: Description is of KPHP
-- ‘BTSBN_ID’: BTSBN_ID is of KPHP
-- ‘FMU_ID’: FMU_ID is of KPHP
create table ‘KPHP’ (  
  ‘KPHP’ VARCHAR(50),
  ‘Description’ VARCHAR(255),
  ‘BTSBN_ID’ DOUBLE,
  ‘Erodibility’ CHAR(10),
  ‘Description’ VARCHAR(255),
  ‘OriginalSource’ VARCHAR(255),
  ‘FMU_ID’ DOUBLE, constraint ‘KPHP_PK’ primary key (‘KPHP’));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table ‘KPHP’. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table ‘KPHP’.
-- ‘KPHP’
-- ‘Description’
-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'KPHP'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'KPHP'.
-- 'KPHP'

-- Create new table 'Iklim'.
-- 'Iklim': Table of Iklim
-- 'Cli_ID': Cli_ID identifies Iklim
-- 'Climate_Type': Climate_Type is of Iklim
-- 'Description': Description is of Iklim
-- 'BTSLBN_ID': BTSLBN_ID is of Iklim
-- 'FMU_ID': FMU_ID is of Iklim
create table 'Iklim' (  
  'Cli_ID' DOUBLE,
  'Climate_Type' CHAR(10),
  'Description' VARCHAR(255),
  'BTSLBN_ID' DOUBLE,
  'FMU_ID' DOUBLE, constraint 'Iklim_PK' primary key ('Cli_ID') );

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Iklim'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'Iklim'.
-- 'Cli_ID'
-- 'Climate_Type'

-- Create new table 'FMU name'.
-- 'FMU name': Table of FMU name
-- 'FMU_ID': Unique Identity of Forest Management Unit
-- 'FMU Name': FMU name
create table 'FMU name' (  
  'FMU_ID' DOUBLE,
  'FMU Name' VARCHAR(250), constraint 'PrimaryKey' primary key ('FMU_ID') );

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'FMU name'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'FMU name'.
-- 'FMU_ID'

-- Create new table 'FMU Boundary'.
-- 'FMU Boundary': Table of FMU Boundary
-- 'FMU_ID': FMU_ID partly identifies FMU Boundary
-- 'AREA': AREA is of Bata'slb
-- 'PERIMETER': PERIMETER is of Bata'slb
-- 'BTSLBN_ID': BTSLBN_ID identifies Bata'slb
-- 'KabupatenID': KabupatenID is of Bata'slb
create table 'FMU Boundary' (  
  'FMU_ID' DOUBLE,
  'AREA' DOUBLE,
  'PERIMETER' DOUBLE,
  'BTSLBN_ID' DOUBLE,
  'KabupatenID' DOUBLE, constraint 'PrimaryKey' primary key ('FMU_ID', 'BTSLBN_ID') );

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'FMU Boundary'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'FMU Boundary'.
-- Create new table 'Desa'.
-- 'Desa': Table of Desa
-- 'KabupatenID': KabupatenID partly identifies Desa
-- 'AREA': AREA is of Desa
-- 'PERIMETER': PERIMETER is of Desa
-- 'DESA_ID': DESA_ID identifies Desa
-- 'DESA': DESA_ID is of Desa
-- 'CDK_Name': CDK_Name is of Desa
create table 'Desa' ('KabupatenID' DOUBLE,
     'AREA' DOUBLE,
     'PERIMETER' DOUBLE,
     'DESA_ID' DOUBLE,
     'DESA' VARCHAR(255),
     'CDK_Name' VARCHAR(255), constraint 'PrimaryKey' primary key ('KabupatenID', 'DESA_ID'));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Desa'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'Desa'.
-- 'KabupatenID'
-- 'DESA_ID'

-- Create new table 'Catchments Area (DAS)'.
-- 'Catchments Area (DAS)': Table of Catchments Area (DAS)
-- 'DAS_ID': DAS_ID identifies DAS
-- 'DASName': DASName is of DAS
-- 'BTSLBN_ID': BTSLBN_ID is of DAS
-- 'FMU_ID': FMU_ID is of Catchments Area (DAS)
create table 'Catchments Area (DAS)' ('DAS_ID' CHAR(10),
     'DASName' VARCHAR(50),
     'BTSLBN_ID' DOUBLE,
     'FMU_ID' DOUBLE, constraint 'DAS_PK' primary key ('DAS_ID'));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Catchments Area (DAS)'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'Catchments Area (DAS)'.
-- 'DAS_ID'

-- Create new table 'Contour'.
-- 'Contour': Table of Contour
-- 'Dxf_Elevat': Dxf_Elevat identifies Contour
-- 'BTSLBN_ID': BTSLBN_ID is of Contour
-- 'FMU_ID': FMU_ID is of Contour
create table 'Contour' ('Dxf_Elevat' DOUBLE,
     'BTSLBN_ID' DOUBLE,
     'FMU_ID' DOUBLE, constraint 'Contour_PK' primary key ('Dxf_Elevat'));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Contour'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not nullable columns for table 'Contour'.
-- 'Dxf_Elevat'

-- Create new table 'Adm_Gov'.

-- 'FMU_ID'
-- 'BTSLBN_ID'
-- 'Adm_Gov' : Table of Adm_Gov
-- 'KabupatenID' : KabupatenID partly identifies Adm_Gov
-- 'Kabupaten' : Kabupaten is of Adm_Gov
create table 'Adm_Gov' (
   'KabupatenID' DOUBLE,
   'Kabupaten' CHAR(10), constraint 'PrimaryKey' primary key ('KabupatenID'));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Adm_Gov'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not null columns for table 'Adm_Gov'.
-- 'KabupatenID'

-- Create new table 'Actual Erosion'.
-- 'Actual Erosion' : Table of Actual Erosion
-- 'RKL' : RKL identifies Actual_erosion
-- 'Erosion_Rate' : Erosion_Rate is of Actual_erosion
-- 'Source' : Source is of Actual_erosion
create table 'Actual Erosion' (
   'RKL' VARCHAR(20),
   'Erosion_Rate' VARCHAR(50),
   'Source' CHAR(50), constraint 'Actual_erosion_PK' primary key ('RKL'));

-- Note: Access does not support the creation of mandatory (not null) constraint using SQL
-- create table construct for table 'Actual Erosion'. The constraint will only be created using DAO
-- if you have connection to the Access MDB file during DDL generation.
-- Not null columns for table 'Actual Erosion'.
-- 'RKL'

-- Add the remaining keys, constraints and indexes for the table 'TGHK'.
create index 'Code' on 'TGHK' ('Code' ASC);

-- Add the remaining keys, constraints and indexes for the table 'Socio-economic'.
create index 'Pop_Type_ID' on 'Socio-economic' ('Pop_Type_ID' ASC);

-- Add the remaining keys, constraints and indexes for the table 'RKL blok'.
create index 'rkrRKL' on 'RKL blok' ('RKL' ASC);

-- Add the remaining keys, constraints and indexes for the table 'River'.
create index 'RiverBTSLBN_ID' on 'River' ('BTSLBN_ID' ASC);

-- Add the remaining keys, constraints and indexes for the table 'Desa'.
create index 'DesaCDK_Name' on 'Desa' ('CDK_Name' ASC);

-- Add the remaining keys, constraints and indexes for the table 'Adm_Gov'.
create index 'Adm_GovCDK_Name' on 'Adm_Gov' ('Kabupaten' ASC,
   'KabupatenID' ASC);

-- Add foreign key constraints to table 'Vegetation'.
alter table 'Vegetation'
   add constraint 'Batasln_Vegetation_FK1' foreign key (
-- Add foreign key constraints to table ‘TGHK’.
alter table ‘TGHK’
    add constraint ‘Bataalbn_TGHK_FK1’ foreign key (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’) 
    references ‘FMU Boundary’ (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’);

-- Add foreign key constraints to table ‘Socio-economic’.
alter table ‘Socio-economic’
    add constraint ‘Needs_socio_FK1’ foreign key (  
        ‘Pop_Type_ID’) 
    references ‘Standard needs per familiy’ (  
        ‘Pop_Type_ID’);

-- Add foreign key constraints to table ‘Slope’.
alter table ‘Slope’
    add constraint ‘Bataalbn_Slope_FK1’ foreign key (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’) 
    references ‘FMU Boundary’ (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’);

-- Add foreign key constraints to table ‘Road’.
alter table ‘Road’
    add constraint ‘Bataalbn_Road_FK1’ foreign key (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’) 
    references ‘FMU Boundary’ (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’);

-- Add foreign key constraints to table ‘RKL blok’.
alter table ‘RKL blok’
    add constraint ‘Actual_erosionrk’ foreign key (  
        ‘RKL’) 
    references ‘Actual Erosion’ (  
        ‘RKL’);

-- Note: If there’s no connection to the Access MDB file, you need to enforce the RI (referential integrity) rule  
-- via Access DBMS for constraint ‘Actual_erosionrk’ in table ‘RKL blok’.
-- For parent table update: DONOT ENFORCE  
-- For parent table delete: DONOT ENFORCE

alter table ‘RKL blok’
    add constraint ‘Bataalbn_rkl_FK1’ foreign key (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’) 
    references ‘FMU Boundary’ (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’);

-- Add foreign key constraints to table ‘River’.
alter table ‘River’
    add constraint ‘BataalbnRiver’ foreign key (  
        ‘FMU_ID’,
        ‘BTLSBN_ID’);
references `FMU Boundary` (  
  `FMU_ID`,  
  `BTSLBN_ID`);

-- Note: If there's no connection to the Access MDB file, you need to enforce the RI (referential integrity) rule  
-- via Access DBMS for constraint 'BataslblnRiver' in table 'River'.
-- For parent table update: DONOT ENFORCE
-- For parent table delete: DONOT ENFORCE

-- Add foreign key constraints to table 'Province'.
alter table 'Province'
  add constraint 'Adm_Gov_Province_FK1' foreign key (  
    `KabupatenID`
  )
  references `Adm_Gov` (  
    `KabupatenID`);

-- Add foreign key constraints to table 'protected area'.
alter table 'protected area'
  add constraint 'Bataslbln_Lindung_FK1' foreign key (  
    `FMU_ID`,  
    `BTSLBN_ID`)
  references `FMU Boundary` (  
    `FMU_ID`,  
    `BTSLBN_ID`);

-- Add foreign key constraints to table 'Land System'.
alter table 'Land System'
  add constraint 'Bataslbln_LandSystem_FK1' foreign key (  
    `FMU_ID`,  
    `BTSLBN_ID`)
  references `FMU Boundary` (  
    `FMU_ID`,  
    `BTSLBN_ID`);

-- Add foreign key constraints to table 'KPHP'.
alter table 'KPHP'
  add constraint 'Bataslbln_KPHP_FK1' foreign key (  
    `FMU_ID`,  
    `BTSLBN_ID`)
  references `FMU Boundary` (  
    `FMU_ID`,  
    `BTSLBN_ID`);

-- Add foreign key constraints to table 'Iklim'.
alter table 'Iklim'
  add constraint 'Bataslbln_Iklim_FK1' foreign key (  
    `FMU_ID`,  
    `BTSLBN_ID`)
  references `FMU Boundary` (  
    `FMU_ID`,  
    `BTSLBN_ID`);

-- Add foreign key constraints to table 'FMU Boundary'.
alter table 'FMU Boundary'
  add constraint 'Adm_Gov_Bataslbln_FK1' foreign key (  
    `KabupatenID`
  )
  references `Adm_Gov` (  
    `KabupatenID`);

alter table 'FMU Boundary'
  add constraint 'FMU nameFMU Boundary' foreign key (  
    `FMU_ID`
  )
  references `FMU name` (  
    `FMU_ID`);
-- Note: If there’s no connection to the Access MDB file, you need to enforce the RI (referential integrity) rule
-- via Access DBMS for constraint ‘FMU nameFMU Boundary’ in table ‘FMU Boundary’.
-- For parent table update: DONOT ENFORCE
-- For parent table delete: DONOT ENFORCE

-- Add foreign key constraints to table ‘Desa’.
alter table ‘Desa’
  add constraint ‘socio_DesalFK1’ foreign key (‘DESA_ID’) references ‘Socio-economic’ (‘DESA_ID’);

alter table ‘Desa’
  add constraint ‘DesaAdm_Gov’ foreign key (‘KabupatenID’) references ‘Adm_Gov’ (‘KabupatenID’);

-- Add foreign key constraints to table ‘Catchments Area (DAS)’.
alter table ‘Catchments Area (DAS)’

-- Add foreign key constraints to table ‘Contour’.
alter table ‘Contour’

-- This is the end of the Visio Enterprise generated SQL DDL script.