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The development of decision support system for monitoring and evaluating forestry industry

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Keywords

DSS, monitoring, evaluation performance, forestry industry

Abstract

The revitalization of forestry industry has been established by Indonesian government in order to create industry which used material in such efficient way, to improve wood product value, and to control industry product capacity. This strategic way was held to overcome the industrial material problem regarding to the large imbalance between forest supply and industry raw material requirements. The first revitalization action was taken by monitoring and evaluating forestry industrial performance. Within current system of monitoring and evaluation, several problems have been identified. A Decision Support System (DSS) is proposed to improve the quality of governmental decision making. The proposed system has been built by processing spatial and non spatial data (forestry industry data reported) and creating a comprehensive way of monitoring the forestry industrial activities, providing a tool to evaluate industry performance, displaying an interactive map of forestry industry and supplier location and material distribution. The system has been tested and implemented on Department of Forestry.

I. Introduction

The uncertainty of wood material supply has become a major problem for Indonesian forestry industries. The large imbalance between the sustainable capacity of the forest and the unlimited desire of forestry industries for fulfilling the demand of raw material necessary has known as the reason of the problem.

To overcome this problem, the Department of Forestry of Republic Indonesia has established the regulation number 34/2002 about forestry industries revitalization. Based on the regulation, Government attempted to revitalize and create industry which efficient in material used, to improve wood product value, and to control industrial product capacity. In order to achieve those goals, the first revitalization action was taken by monitoring and evaluating industrial performance based on

criterion and indicators regulated on P.17/2004.

Within the revitalization actions, there were some problems could be identified. The current industrial monitoring and evaluation system, consumed time and cost and resulted in disintegrated of decision making between sub directorates on Department of Forestry.

The purpose of this research was to develop a system that can improve the current system and could be used by Government in the context of monitoring and evaluating of forestry industries. This research is expected to give contribution to the government in supporting of decision making. The main objective of this research was to provide Decision Support System (DSS) tool for monitoring and evaluating of forestry industries.

Specifically, the research was focused on the development of forestry industry database system, GIS based information system and a decision support system tool to assess forestry industry performance. The system implementation took place at the Directorate General of Forest Production Management. The potential users of the system were : Forest Product Manufacture Sub Directorate, Production Sub Directorate, Marketing and Forestry Industrial Performance Assessment Sub Directorate, Department of Forestry, Jakarta. The data was collected on Forest Production Management Directorate General, consisted of forestry industries data at 33 Indonesia provinces.

2. Methodology

This research has been conducted on March until July 2006 and taken location at Directorate General of Forest Production Management, Department of Forestry, Jakarta.

In general, there are two type of data used on this research, consisted of spatial and non spatial data. The spatial data consisted of natural and plantation forest concession digital map (vector data) for year 2005. Data was obtained from *Badan Planologi*, Department of Forestry. The other data was Indonesian village digital map (vector data) for year 1995 from *Biro Pusat Statistik (BPS)*, Jakarta. The non spatial data consisted of : Forestry industries data report obtained from *Balai Sertifikasi Pengusahaan Hasil Hutan* (BSPHH) for years 2003 and 2004, material document report, Forestry industrial performance assessment report for year 2003 and registering report of forestry industries for year 2004.

The hardware used for accomplishing this research was a computer with minimum specifications on Windows XP operating system run on PC Pentium IV class with minimum 1.9 GHz , RAM 256 MB or more and SVGA screen with minimum resolution 1024 x 768 pixels. The system was developed by using Visual Basic 6.0 under Microsoft Windows XP Professional Edition and ESRI Map Object 2.1. ESRI ArcView 3.x was used to process spatial data. Microsoft Access was selected for developing database management system.

Figure 2.1. presented the development stage of the system, consisted of analysis stage, design stage, and implementation stage. The analysis stage was focused on identifying problems in the current system, user needs, and inventorying data needed for the development of the system. The design stage was aimed for answering how the system developed and accomplishing the requirements on analysis stage specified what a system should to do to meet the need of users. The design stage consisted of analyzing hardware, software and technique required, database, user interface and code design. The implementation stage consisted of selection of software and hardware, database development, code construction, and programs testing.

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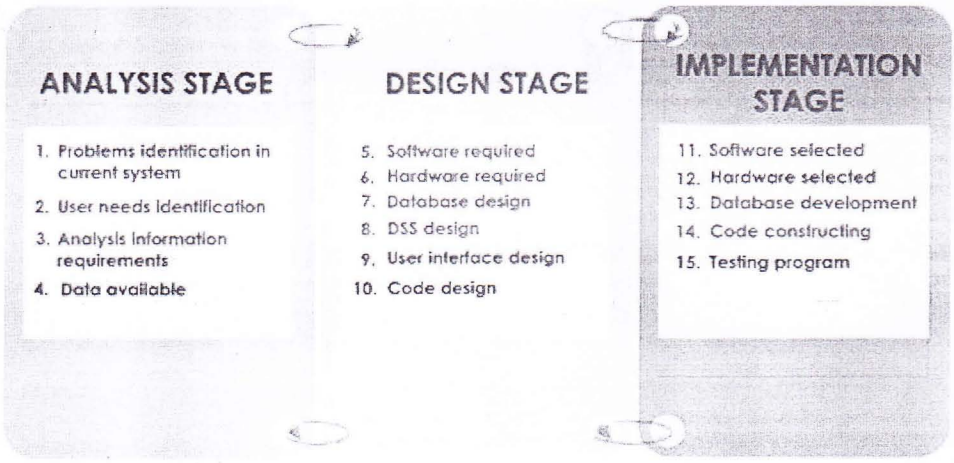

Figure 2.1. Research stages

3. Result and Discussion

3.1. Problems identification at the current system

There were several problems identified in the current system of monitoring and evaluation of forestry industries such as time and cost inefficiency, disintegrated of data handling and need of DSS development for evaluation of forestry industries.

The evaluation of industry performance has developped in 2004 and focused for industry with more than 6000 m^3 of production capacities. For the implementation, government has been agreed that *LPI Mampu* as the independent organization for conducting the evaluation and assessment of the forestry industries actions. But, based on the evaluation, the highest cost and time was appeared. This fact could be seen from the data described on Table 3.1.

Referring to the data described on Table 3.1, the average cost needed by PT. *Alam Jabar Indo Malik, as the LPI Mampu,* was achieving 136.5 million rupiah with only 36 days used to accomplish the evaluation. Until 2006, it was reported that only 98 industries have been surveyed by *LPI Mampu*. The numbers of forestry industry with a capacity more than 6000 m^3 was 294 (Department of Forestry, 2005). By calculating the remain of industries that was not surveyed yet, the estimation cost for assessing forestry industry would achieve 26,754 billion rupiah.

Forestry industries data were handled by three sub directorates : Production Sub Directorate that handled material used and production reports, Marketing and Industry's Assessment Sub Directorate that was focused on market product report; and Forest Product Manufacture Sub Directorate which handled forestry industry data licenses, machines used in production, workers and production capacity reports.

The different scope of data handled

Table 3.1. Time and cost for assessing forestry industry by LPI Mampu

No.	LPI Mampu	Forest Industry	Cost (million rupiah)	Staff involved	Time to accomplished
1.	PT. Alam Jabbar Indo Malik	PT. Batasan, West Kalimantan	137	7 experts	36 days
		PT. Retrindo Nusantara, East Java	123	7 experts	36 days
		PT. Putra Setia Utama Timber, Jambi	159	7 experts	36 days
		PT. Andatu, Lampung	127	7 experts	36 days

Source : LPI Mampu, PT. Alam Jabbar Indo Malik, 2003

between sub directorates was caused spread information and disintegrated of decision making. This situation was occurred because of different authority between sub directorates in evaluating forestry industries. The fact was realized with the case that the Forest Product Manufacture Sub Directorate lengthened the license period of an industry, however, the Production Sub Directorate identified the illegal of material used. Based on the regulation, an industry identified with the use of illegal material could not lengthen its license.

The assessment of forestry industrial performance has been arranged based on Ministry of Forestry Regulation number P.17/2004 about Procedure in Assessing Sawmill, Chipwood, Veneer, and Plywood industries. The assessment process was carried out by assessing alternatives or set of options consists on criterion and indicator. In the assessment performance implementation, especially for assessing industry which has a capacity more than 6000 m^3, *LPI Mampu* was the selected organization.

Based on the process and technique of current system assessment it was found that the assessment performance of forestry industries was still done manually. There was no system available for automatically ranking, scoring and categorizing industry performance and the process of assessment was done based on *LPI Mampu* survey without involving the functionality of each sub directorate.

In general, there were four (4) kinds of user needs to overcome current system problems such as :

1. Development of database system for organizing forestry industry data based on scope of each sub directorate data handled,
2. Development of GIS based information system for monitoring location of forestry industry, supplier, and used to show material distribution pattern of forestry industry,
3. Development a decision support system tool for evaluating forestry industry performance, and
4. Development of an interconnection area (LAN - Local Area Network) for facilitating data exchange between sub directorates.

3.2. Design Stages

On the design stage, the workflow of system proposed (Figure 3.1) was concept based on problems and user needs identification as explained on the analysis stage.

The operation of the system were described on Context Diagram (Figure 3.2) and Data Flow Diagram (DFD) (Figure 3.3).

There were three (3) potential user included, consisted of Forest Product Manufacture Sub Directorate, Production Sub Directorate and Marketing and Industry Assessment Sub Directorate. The Forest Product Manufacture Sub Directorate could use the system to monitor, evaluate and organize forestry industries data such as profile, license availability, workers, machine production used, environmental impact, financial health, and the location of industry. The Production Sub Directorate could use the system to monitor, evaluate and organize forestry industries data such as production, wood material requirements, and the location of industry. The Marketing and Industry Assessment Sub Directorate could use the system to monitor, evaluate, and organize forestry industries data especially in forestry industry marketing and also the location of industry.

DFD diagram on Figure 3.3 describes the process of data on the system developed and the contribution of the end users (sub directorate) to the data processing. There were three (3) parts of main processes consisting of input data, process, and the output of the system. The data flow began

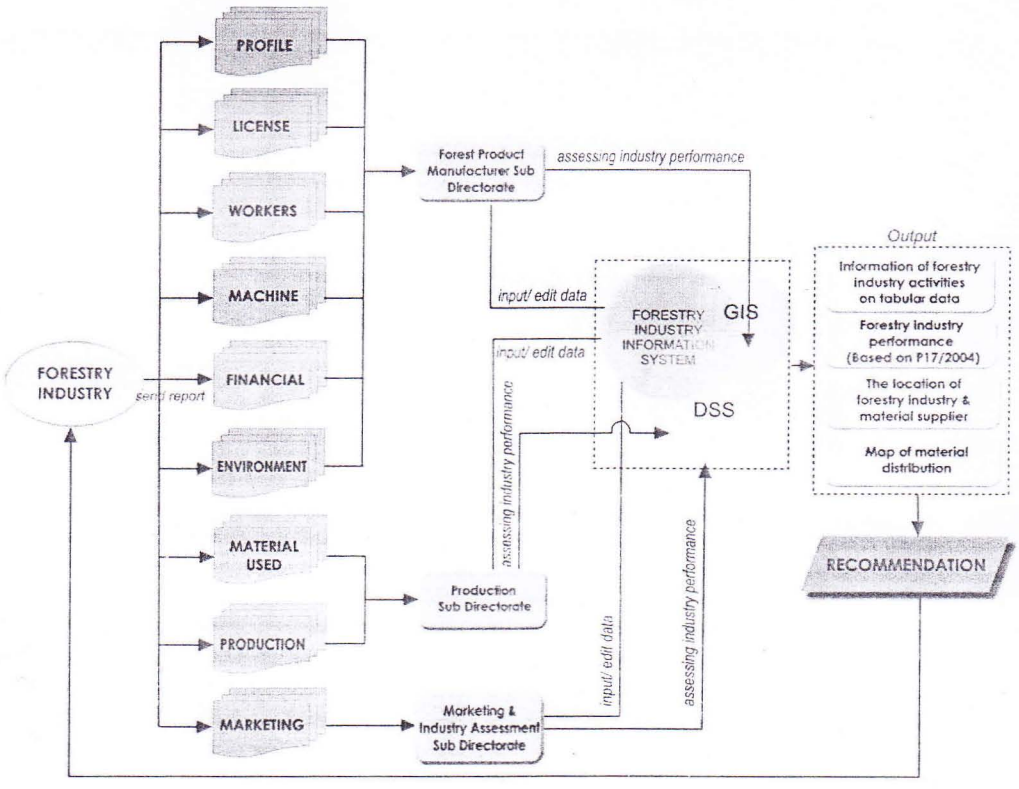

Figure 3.1. Workflow of proposed system

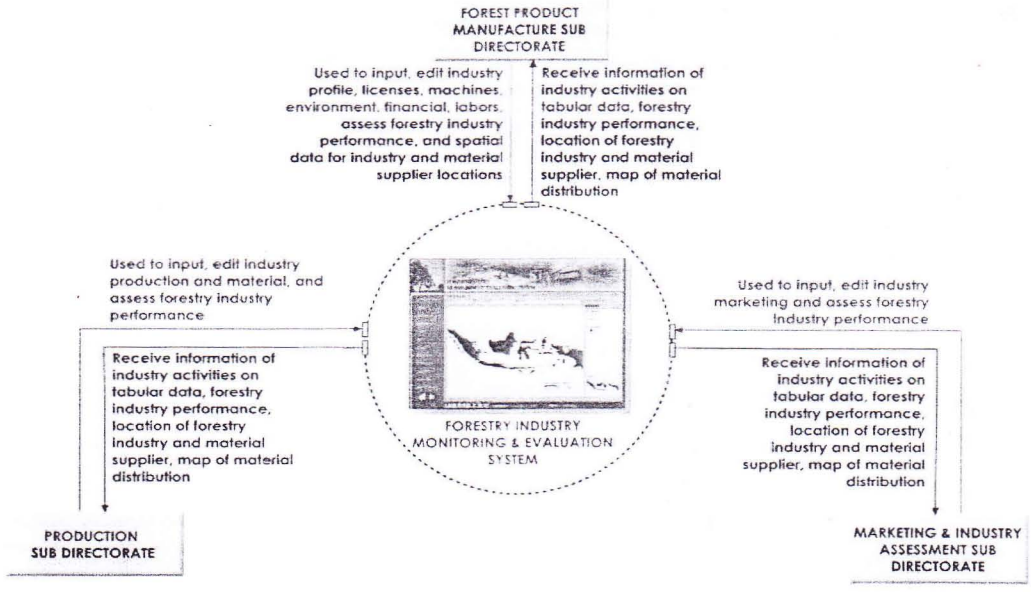

Figure 3.2. Context diagram

with the input process for non spatial data (forestry industries data report) by the operator on each external entity through the system. All the data inputted then stored on the Data Based Management System. Plotting the location was the second process of the system in order to locate forestry industries and supplier of the materials.

Referring to the overall process, there were several output provided consisted of Information of forestry industry activities, Forestry industrial performance, Location of

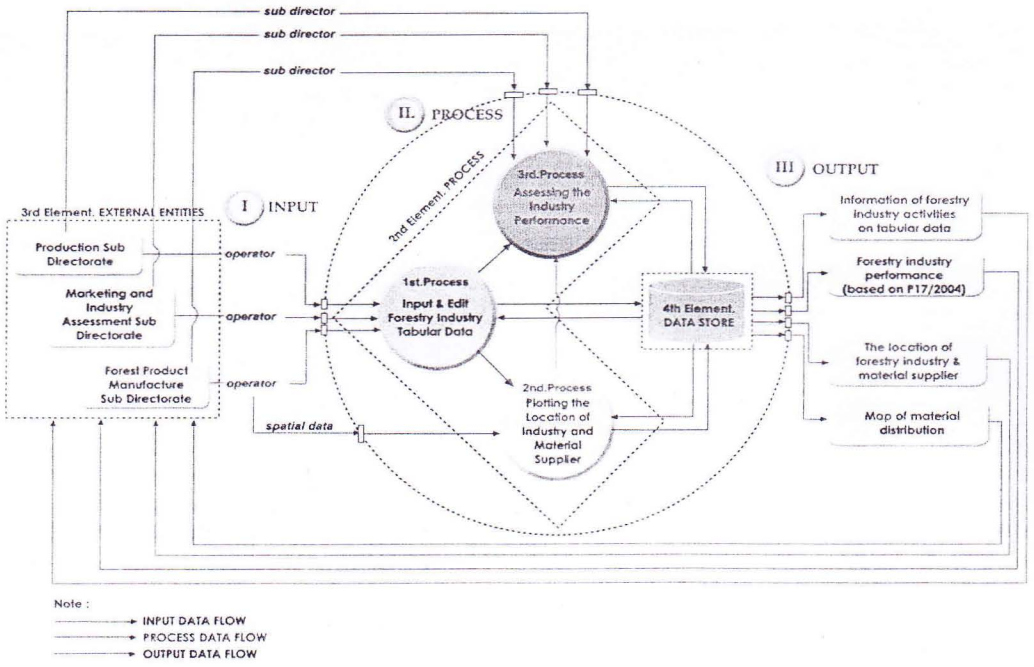

Figure 3.3. Data flow diagram level 0

forestry industries and suppliers and Maps of material distribution. All those output was used to monitor and evaluate forestry industries.

The DSS was specifically built to assess the performance of forestry industries. DSS method was selected based on regulation number P.17/2004 about Procedure in Assessing Sawmill, Chip wood, Veneer, and Plywood industries. There were 10 criteria presented on the regulation, consisted of : Industrial license, Material requirements, Legality of materials, Capacity setting and product allowance, Efficiency in materials used, Industry financial health, Environment standard quality, RPBBI document, Periodical report availability and Workers used. For establishment of regulation, several indicators were available on each criterion and several parameters were existed on each indicator. There were *21 indicators* and *69 parameters* used to assess forestry industrial performance.

In performance assessment process, government has been grouped the indicators into three (3) category, consisted of precondition indicators, principal indicators and contributed indicators. Precondition indicators, defined as the indicators that must be fulfilled by industries. When industry could not complete one of the indicators, the industry was directly defined on a worse category. Principal indicators, defined as the indicators that should be completed by the industry. Contributed indicators were used to assess industry activities that contribute to the industry effort.

The system has been developed as an automatically assessment. The rules of performance assessment on developing the DSS was illustrated on Figure 3.4.

3.3. Implementation Stage

The main page of the system was created by conducting codes. This main page was equipped with map to indicate the location of forestry industries and forestry suppliers. Main page allowed user to explore the map. User could do zoom in and zoom out to the map and also gathering information from the map by using information tool. Main page also allowed user to find out the information

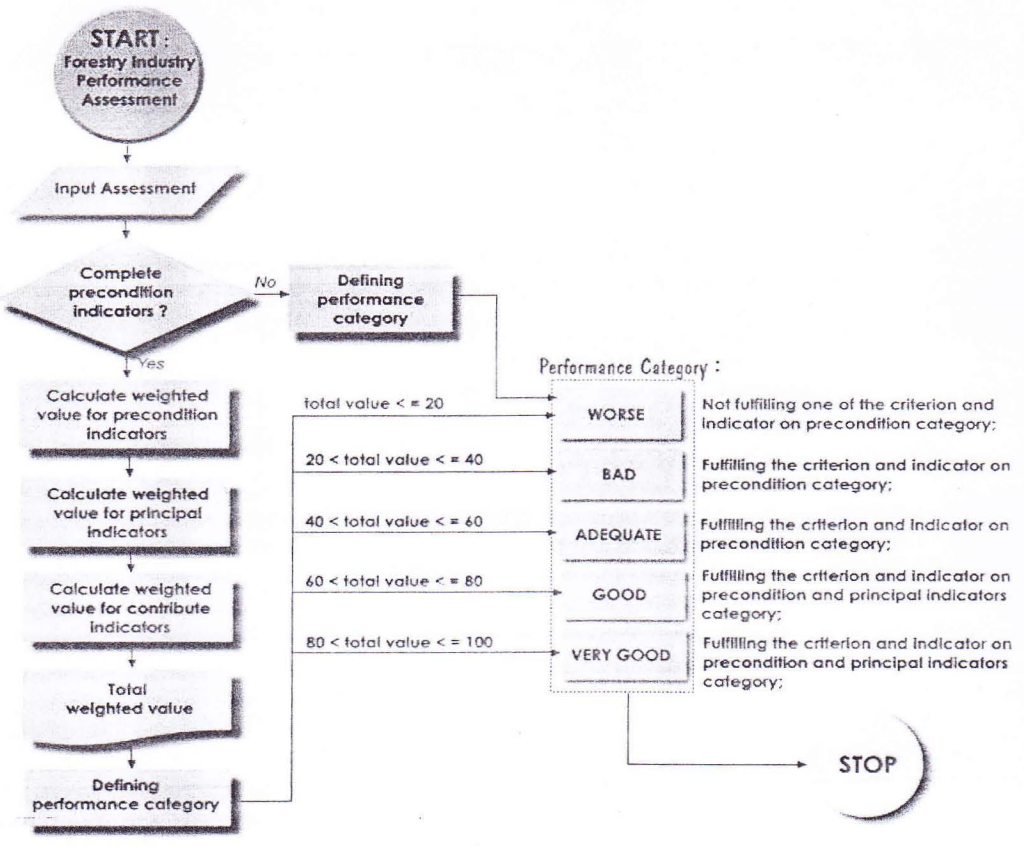

Figure 3.4. Rules of performance assessment

of forestry industry (company profile, licenses, materials, production, machine, labors, financial, environment, reporting, and performance) by selecting to the intended industry.

For supporting the decision making of the end users in monitoring and evaluating forestry industry, the system also provide some capabilities, consisted of : detecting the proper planning and realization material supplier. The system has been designed to detect the obedience of industry on the establishing regulation; for having supplier that identical in material planning and realization, The system could also detecting the value of material supply that exceeds the allowable cutting, detecting the validity license of forest product examiner, detecting production that exceed the product capacity allowance and mapping the material distribution.

Based on the result of the system test, it has been succeeded on completing the user needs in monitoring and evaluating of the forestry industries. The system could also use on helping government to monitor industrial activities, organizing forestry industrial data, and to evaluate industrial performance. Data limitation was occurred as a restriction on providing complete information. There were incomplete data available on Department of Forestry due to decentralization era that created disintegrated policy and authority between central government and regional government and difficulties in data and information exchange.

4. Conclusion and Recommendation

The weakness in the current system of monitoring and evaluating forestry industries has been analyzed and need to be improved by developing a new comprehensive system. The proposed system has been built with more comprehensive way by integrating

information system, decision support system, and geographical information system in monitoring and evaluating forestry industries. The proposed system has been built to provide some capabilities on detecting the proper planning and realization of forestry material supplier, detecting the exceeds the allowable cutting, detecting the validity license of forestry product, detecting the exceed of product capacity allowance and mapping the material distribution.

FIMES (Forestry Industry Monitoring and Evaluation System) has been tested and proved could be used as monitoring and evaluation of forestry industries by assessing the industrial performance.

The research was focused only for monitoring and evaluating primary forestry industry. There are actually secondary industries that need to be included on the system.

Because of the data limitation, the system proposed was tested only for industries which data available on Department of Forestry. It was recommended to test the system by including all industries to see the stabilization of the system when the database is accessed.

For the future research, the used of GIS is needed to be improved in order to help Government to provide the spatial analysis regarding to the position of industry with the capability of forest supply and material supplier.

It is also recommended to develop the system on web based in order to ease Government in data inputting through the system and to overcome the problems in data collected.

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