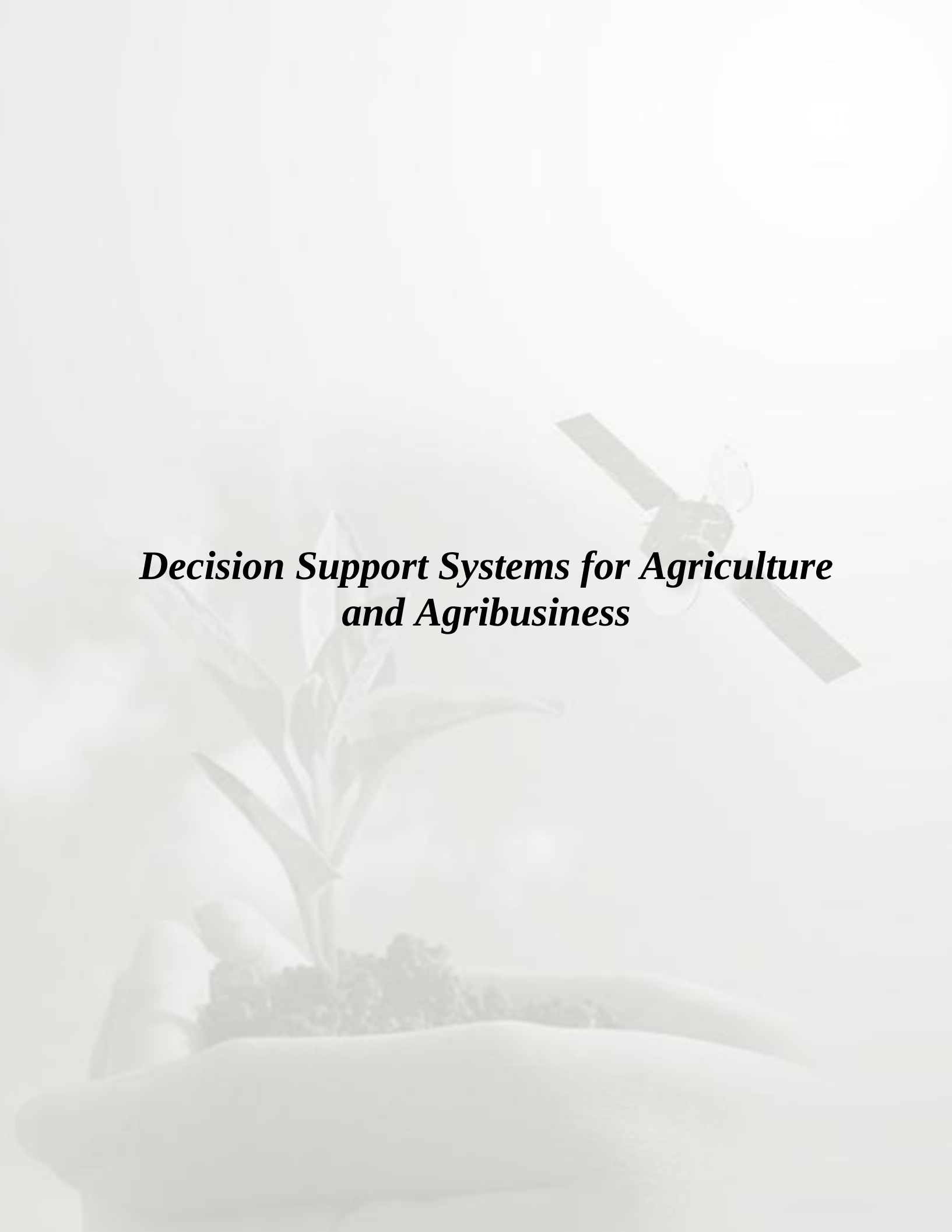

Decision Support Systems for Agriculture and Agribusiness

Decision Support System for Small Scale Potato Based Agroindustry (Case Study Bandung Regency)

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ABSTRACT

Development of Decision Support System of Small Scale Potato Agro industry called PoDSS (Potato Decision Support System) is expected to help decision maker in determining the agro industrial planning. PoDSS consisted of four integrated system, dialog system, central processing system, data based system, and model based system. Dialog based system could be used as direct interaction media with users. Central processing system was the main system that combined and managed the individual systems to become one whole system. Data based system comprised with static and dynamic data based. Model based system is developed with five supporting sub model, potential product criteria weighing sub model, potential product decision sub model, potential location criteria weighing sub model, potential location decision sub model, and financial feasibility sub model. Financial feasibility sub model could be used for analyzing the feasibility of the potato chips industry. Based on calculation, the potato chips industry has NPV value of IDR 51.038.439,-, IRR value of 49,57%, B/C Ratio of 2,41 and Pay Back Period value of 2,97 years. Model would be validated with other industrial data for comparison of model use.

***Keyword**s : DSS, system, model decision, feasibility, financial analysis.*

INTRODUCTION

Indonesia is an agricultural country with abundant of natural resources. Agricultural sector plays an important role on strategic planning of economic and development in Indonesia.

On of the most relative potential product in agricultural sector are potatoes (*Solanum tuberosum L)*. Statistic data from FAO (2007) showed that the total area of potatoes plants in Indonesia is 62,839 Ha with the production of 851,485 tonnes.

Potatoes has relatively stable price at the market, since potatoes can be stored compare to vegetables like tomatoes or cabbages that have very short lifetime. Potatoes should be processed before consuming, such as French fries, chips, soup or other snacks.

Potatoes could be processed as raw material for industries especially agro industries in order to increase the added value of potatoes. Agricultural products are perishable. The use of the product as raw materials for industries could extend the lifetime and increasing the value of product. According to Austin (1992), the definition of agro industry is the effort of micro, small, medium and large scale of industries that process the raw material origin from plants or animals, with the characteristics is the chemical and physically transformation in order to increase the added value of the commodity. The example of processed product could be derived from potatoes are chips, potato powder and potato flakes.

The decision of choosing the alternatives products derived from potatoes should consider so many factors. The factors are related to each other such as the variety of potatoes, the appropriate quality of potatoes needed by industries, the continuation of potato production, industrial location and consumer behaviour. Decision Support System for small scale potato based agro industry could be used as the support for decision maker in choosing potential agro industrial product, finding the appropriate location for agro industrial development and defining the techno-economic feasibility for agro industrial development.

The objective of this research is to develop a decision support system for small scale potato based agro industry that can be used as a supporting tool for decision maker in determining the alternative of investment in potato based industries. The decision support system is validated using the data of Bandung Regency.

METHODOLOGY

The Decision Support System of Small Scale Potato Based Agro industry is designed and developed using system approach. The system approach is an overview of holistic methodology focusing on integration and relation between elements. The approach could change the mindset on solving the problem using model as a simplification of the system. Model is used since it is easier to understand the problem more simpler compare to the real system that is very complex (Hartrisari, 2007).

With the system approach, the solving problem is begun with the need analysis of the stakeholders related to the real system. The needs should be categorized in synergic and contradictive needs. Based on the needs, the identification of the system is performed. Model is developed, verified and validated before implementation. Figure 1 presented the system approach flow diagram.

Computer based decision support system is a computer based system that has capability of user interactive and flexibility and is developed in order to support the problem solving and decision making. In general, the decision support system consists of three components: data base management system, model base management system and dialog management system. Data base management system consists of data related to the system. Model base management system comprises of models can be used for analysing problem faced in the system. Dialog management provides the communication between the user and the commands at decision support systems. Figure 2 shows the basic structure of decision support system.

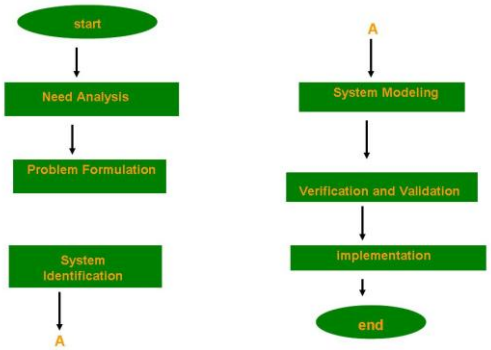

Figure 1. System Approach Flow Diagram

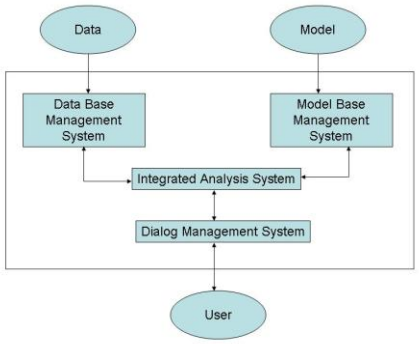

Figure 2. Basic Structure of Decision Support System

The model in this research is focused on the feasibility study for the industrial investment, comprises of Net Present value (NPV), Benefit Cost Ratio (B/C ratio), Internal Rate of Return (IRR) and Pay back Period (PBP).

NPV is the difference between the present value of benefit and cost. The positive value of NPV presents that the project will give the benefit and the negative value present the loss of the project. The formula used for calculating the NPV is as follows:

$$NPV = \sum_{1}^{n} (Bt - Ct)/(1+i)^{t}$$

Bt : Total revenue at year t

Ct : Total cost at year t

i : Interest rate

n : Project time length

B/C ratio is the comparison value between the total benefit and the total cost. The project will give benefit or feasible to conduct if the value of B/C ratio is 1 and above. If the value is below 1, the project is not feasible to conduct. The B/C ratio is calculated is follows:

$$NetB/C = \frac{\sum_{t=0}^{n} (Bt - Ct)/(1+i)^{t}}{\sum_{t=0}^{n} (Bt - Ct)/(1+i)^{t}} \quad \frac{for(Bt - Ct > 0)}{for(Bt - Ct < 0)}$$

IRR is the rate of return of the capital used in the project, presents in the percentage of return per year. A project is feasible to conduct if the value of

IRR is more than the bank interest. The formula for calculating the IRR is presented below.

$$IRR = \frac{NPV_1 - (i_2 - i_1)}{NPV_1 - NPV_2}$$

NPV_i : Net Present Value at i

Expert's judgement is used for determining the decision alternatives. Experts are chosen based on their competency, knowledge and practical knowledge related to the system, in this case the potato based agro industries. The experts for this research are the stakeholders in potato based agro industries comprise of farmers, private sectors, researcher and regency government. The judgment is then treated whether with Eckenrode weighing method and pair wise comparison method.

Model developed could be executed for the personal computer equipped with minimum Microsoft Windows operation system, 512 MB RAM and 90 GB hard disk.

SYSTEM DESIGN OF DECISION SUPPORT SYSTEM FOR SMALL SCALE POTATO BASED AGROINDUSTRY

The decision support system for small scale potato based agro industry is developed and designed in one package of integrated computer program. The communication with users is designed through the dialog management system. Program is designed also to identify the input from the user, combining with the data provided in the data base management system. The data than treated and analysed with the techniques provided in the model based management system. Data based management system consists of static and dynamic data. Static data presents general information that can not be changed by the users. The change is provided in the dynamic data base. As presented before, the model base management is focusing on the feasibility analysis. Figure 3 shows the decision support system structure for small scale potato based agro industry.

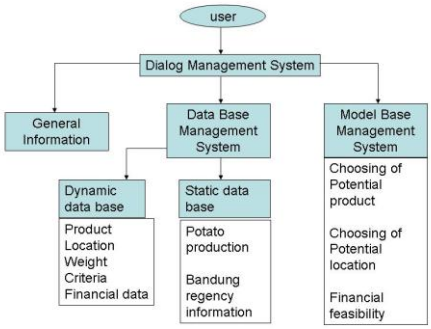

Figure 3. Decision Support System Structure for Small Scale Potato Based Agro industry

RESULTS AND DISCUSSION

Model is provided with the password so that the validity of the computer program is always controlled. Users are divided as general users that can only get information and have no rights to change data. The registered users could change data for the simulation requirements, but could not change the system. The administrator has all the rights, change the data input and system as well.

Once model is executed, the main menu is presented. The first step of model is to choose the potential product could be made from potatoes. For that reason, model needs the weight and criteria of the identified indicators. Expert judgments resulted that the factors influenced in the potential product alternatives are: potential market (0.38), added value of product (0.32), product processing (0.18), environmental impact (0.08) and human resources (0.04). From the product alternatives offered, the results of the judgements are: potato chips (6.83), potato "krupuk" (6, 56) and potato powder (6.08). Even the value of chips and krupuk is not significantly different, but for this research we only use the potato chips as example for continuation of model validation.

The next step after product is chosen (potato chips); the determination of the agro industrial location should be performed. The factors influencing the location determination are: raw material production (0.33), community acceptability (0.23), land (0.20), and human resources provision (0.07). Based on the judgment for Bandung regency, the city of Pangalengan, Kertasari and Cimenyan are potential for industrial location. Finally, Pangalengan is chose for the industrial location.

The final step is calculating the feasibility study of potato chip agro industry located at

Pangalengan. The assumption in calculating the feasibility is presented at table 1.

Table 1. Assumption used in Financial Feasibility Calculation

No.	Description	Value
1	Percentage of product sold	100%
2	Price of raw material	Rp 40,000
3	Maintenance Cost	2%/year
4	Interest	18%
5	Tax	
	up to Rp 25,000,000	5%
	Rp 25,000,000 - Rp 50,000,000	10%
	Rp 50,000,000 - Rp 100,000,000	15%
	Rp 100,000,000 - Rp 200,000,000	25%
	more than Rp 200,000,000	35%
6	Production percentage at year 1	70%
	Production percentage at year 2	80%
	Production percentage at year 3	95%
	Production percentage at year 4-10	100%
7	yield	20%

Model will calculate the financial feasibility of potato chips agro industry with the capacity of 5.57 tonnes of potato chips per year. The results of financial feasibility are as follows: NPV equals Rp 51,038,439 with IRR 49,57%, B/C ratio 2.41 and the pay back period of 2.97 years. Sensitivity analysis also performed resulted in that the decrease of product price and the increase of production cost up to 5% still resulted in the feasible financial calculation. Table 2. presents the comparison between financial calculation and sensitivity analysis.

Table 2. Financial Feasibility Results and Sensitivity Analysis

Criteria	Scenario 1 (as assumed)	Scenario 2 (decrease of product price 5%)	Scenario 3 (increase of production cost 5%)
Product Price (Rp)	36,800	34,960	36,800
NPV (Rp)	51,038,439	5,304,379	10.924.769
IRR (%)	49,51	18,91	19,88
B/C ratio	2,41	1.12	1,24
PBP (year)	2.97	4.67	4,21

CONCLUSION

Model developed could perform the effectiveness and efficiency of calculation and proven that could help the decision maker on choosing the product alternatives, potential industrial location and also the financial; feasibility.

In the verification and validation step, taking the case at Bandung regency, it is shown that potato chips is chosen as potential product, and will be built at Pangalengan. The financial calculation shows that potato chips agro industry is feasible to develop.

REFERENCES

1. Austin. J.E. 1992. Agroindustrial Project Analysis. The John Hopkins University Press. Maryland.
2. BPS. 2004. Bandung dalam Angka. BPS.
3. DeGarmo, E.P., W.G. Sullivan, J.A. Bontadelli dan E.M. Wicks. 1997. *Engineering Economy*. Prentice-Hall, Inc. Published by Simon & Schuster / A Viacom Company, New Jersey.
4. Hartrisari. 2007. System Dynamics : Concept and Application in Environment and Industries. SEAMEO BIOTROP. Bogor. (in Bahasa)
5. Turban E. 1990. Decision Support System and Expert System.Mac Millan Publishing Company, New York