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Optimization of Business Partners Feasibility for Oil Palm Revitalization Using Fuzzy Approach

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***Abstract*— Resource potential of North Sumatra supports the idea to make North Sumatra as a national barometer of oil palm. The development of agro-CPO and its derivatives have great potential to grow rapidly because it is still 5.5% of the area planted with oil palm than 133 million hectares of potential land. Efforts to strengthen the availability of raw materials for CPO agroindustry and its derivatives by conducting Plantation Revitalization required with financial support from the banking system. Program of Plantation Revitalization is an effort to accelerate the development of smallholders through the expansion, replanting and rehabilitation of plantation-backed loans and investment of banking and interest subsidy by the government involving plantation companies as partners of the development, processing and marketing. The role of banks is quite large, but face problems of the large risks involved and the complexity of processes. Methode of Fuzzy Analytic Hierarchy Process and Fuzzy Inference System integrated in the studies conducted. In AHP Fuzzy method, based on expert opinion the weighting criteria is resulting. Weighting being input to the FIS method to determine the feasibility of plantation companies as business partners to obtain credit financing. The study results show that not only financial performance but also non-financial performance should be taken into account in determining the creditworthiness of Revitalization Plantation program.**

***Keywords*— Plantation Revitalization; Banking Risk; Credit Eligibility; Fuzzy Analytic Hierarchy Process; Fuzzy Inference System.**

I. INTRODUCTION

The potential of natural resources in North Sumatra Indonesia with its large area plantation reached 1.2 million ha out of the total 7.9 million ha (15.2% of the plantation area in Indonesia), the composition of the unproductive young plants are estimated around 1.26 million ha or 17.2% of the national oil palm plantations, and exports of CPO 7.9% out of the total Indonesian exports. The development of oil palm agroindustry and its downstream has a chance for a greater development because from the 133 million ha of land potential, it is still 7.9 million ha (5.5%) were planted with oil palm. To support the idea of making North Sumatra as the barometer of the national palm oil required the efforts to strengthen the availability of raw materials CPO agroindustry through the expansion of plantation and replanting (revitalization estate) to support the development of Palm Oil agroindustry in North Sumatra.

Plantation Revitalization is an efforts to accelerating the development of the smallholders through expansion, replanting and rehabilitation of plantation backed-loans and investment banking and interest subsidy by the government involving plantations companies as development partners, processing and marketing [2]. Plantation revitalization policies specifically include interest subsidy at the time of making the investment interest expense is lighter, but does not include the various provisions related reforms as the price of seeds is not cheap for farmers, land titling process difficulties, difficulties in the process of licensing the establishment of co-operatives, and gave no incentive for the banks are carrying out plantation revitalization program. The banking as managing plantation revitalization program face several issues associated effort to optimize its role among others is the [17]:

1. Banking faced larger risk, due to the lack of self-financing and collateral credit are generally funded as an object cannot be tied perfectly at the start of credit is realized.

2. The process is complicated due to the necessity of various procedures and completeness that involves various agencies (such as Department of Finance, Department of Agriculture, Department of Forestry, Department of Cooperatives, National Land Agency, local government and the farming community as a core company of plasma and business partners), the channelling of credit or financing on these programs become more complicated.

Very dominant in banking practice interacting with business partners rather than other parties such as cooperatives and the government. Therefore this research study is more focused on the interaction.

Plantation Company as a business partners will be guarantor (avalis) bank loans disbursed to farmers. Managing it with professional management so that the processing and marketing of products to meet obligations to the bank and also provide maximum benefits to the farmers.

Research using experts to evaluate the credit worthiness of oil palm agroindustry with consideration of 1) the credibility of management (eligibility location, area and land class, experience and skills in the field of business and industrial oil palm plantations, appropriateness bad legality of the law in collateral and marketing experience, the level of technology), 2) the debt repayment ability (self-financing, cash flow, investment stream side), 3) guarantee: assessing the collateral ratio and the feasibility of its juridical guarantees and marketability[13].

A study to analyse the feasibility of the development of oil palm plantation estates (as business partners) and smallholdings as well as the construction of processing factories by following the pattern of plantation revitalization has been done only by using financial considerations [6].

Fuzzy approaches are widely used among others for the creation of models with incomplete information in the study Constantino [1], fuzzy sets and fuzzy systems in research Glackina for analysis of the company's acquisition [5], research Secme using fuzzy for evaluating banking performance [19], fuzy logic used Nainggolan to study the influence of the magnetic field [16], fuzzy logic control is used in the analysis of Syariah Bank by Muhib [12], fuzzy AHP is used in making the priority attribute of automotive product development by Nepal [14] and review progress FAHP using non-additive weights and fuzzy score by Yudhishthira [22], Wua using fuzzy MCDM to evaluate the performance of the banking [21], Elsayed using fuzzy Inference System for the risk assessment [4], fuzzy neural network used GS Ng for an early warning system for bank failure [15] and also on Tungga used for early warning system for predicting bank failures [20].

II. PROBLEM STATEMENT

Great potential in terms of exports of North Sumatra, land, seeds, labour and geographical location make it as planned to the area where the palm oil industry in Indonesia. Therefore an attempt to optimize the feasibility analysis company as business partners to revitalize oil palm plantations needs to be done. Because the role of banks as providers of financing large enough to strengthen the availability of raw materials to support the development of oil palm agro-industry in North Sumatra and North Sumatra to make palm oil as a national barometer.

III. RESEARCH OBJECTIVES

The research objective is to produce tools that can be utilized in the selection of banking plantation companies as business partners for smallholders or cooperatives using clear rules and be careful to minimize the amount of risk faced by banks.

IV. METHODOLOGY

A. Framework

Research framework followed Fuzzy Logic Control, namely fuzzy sets and fuzzy logic are applied to control the problem. This method describes the control problem in a state of uncertainty and imprecision. Very effective used when high precision is not required and the purpose of having the variable control that can be used for measurement and estimation. Base fuzzy logic control is conceptually introduced by Zadeh (1973) and later developed by Mamdani (1975) and in depth written by Yager and Filev (1984).

B. Procedures

1) Preliminary study: Preliminary study was conducted to explore the resources on research. At this stage, based on field observations and literature review to obtain an overview of the problems that can be solved by using methods that are relevant to the expert system. In addition to literature study, interviews were conducted with experts plantation revitalization or relevant. Of direct and indirect observations to formulate a goal and issues that need attention. In this study, an expert is absolutely necessary, expert opinion has a very significant contribution in the determination of the solution.

2) Study Literature: Study literature is always done in accordance with the theories and methods of support needs in each phase. Studies conducted to find references that support the topic of problems and methods of solution search. The topics that are the focus of the literature search is Plantation Revitalization, Financing for farmers participating in Plantation Revitalization Program, Fuzzy AHP and Fuzzy Inference System is used in data processing as well as an assessment of expert opinion based on a model that has been developed.

3) Selection of experts: According to Hart (1986) in the process of knowledge acquisition, expert determination or related parties are based on the following considerations: 1) the existence of resources (experts), affordability and willingness to be interviewed, 2) has a reputation, position and has demonstrated its credibility as an expert, 3) have experienced in their field. In this study, the experts involved in the decision-making is representing the banking and oil palm plantations.

4) Data collection: Data collected included primary and secondary data. Secondary data includes data that can describe the target and actual program (such as land area, amount of financing, distribution of program locations, and business partners). Primary data were collected to gather information from experts directly either structured or unstructured. Methods are not structured in the form of

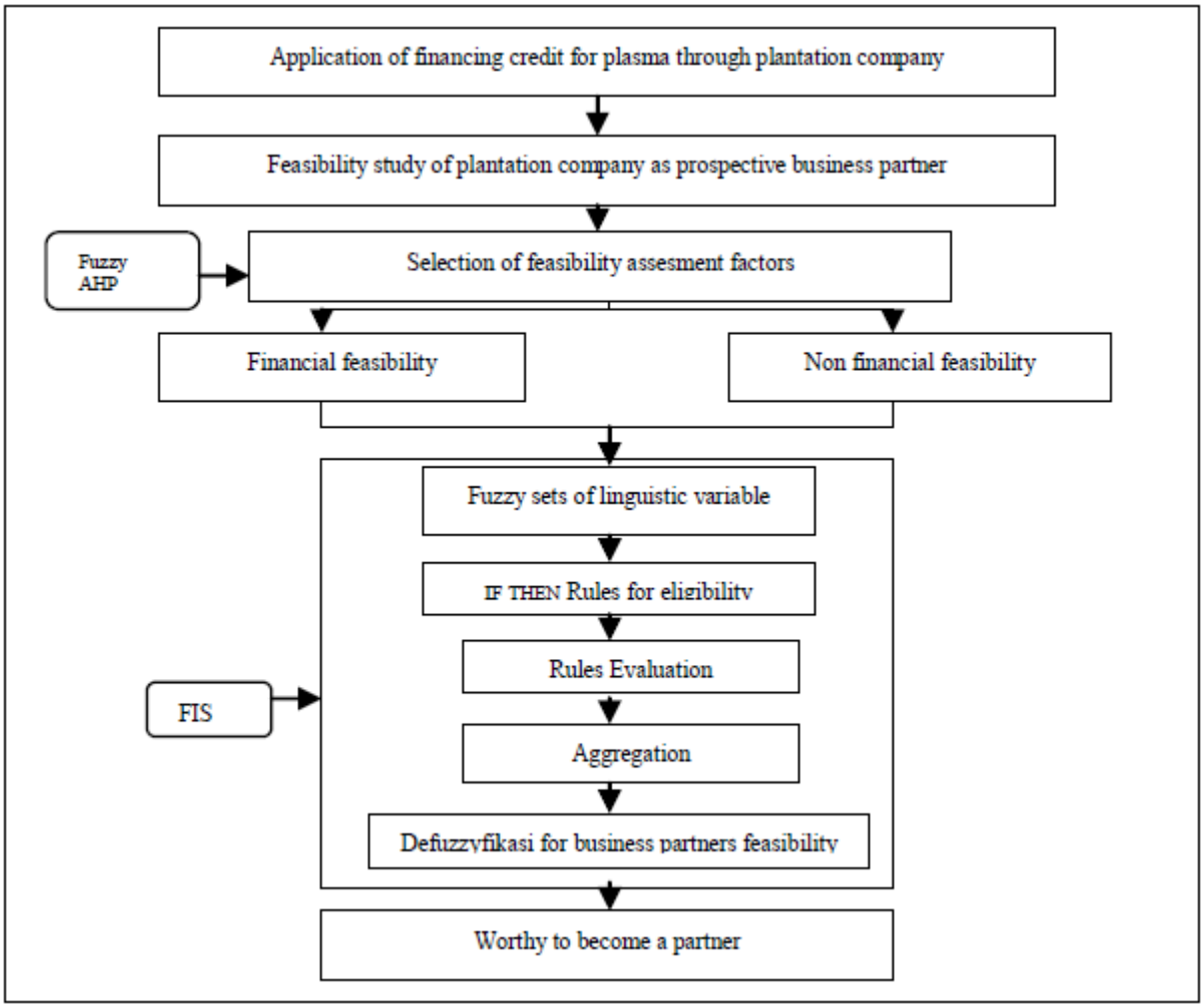

Fig. 1 Research Framework

brainstorming that is used during exploration expert opinion related to the research topic. Meanwhile structured method used to design tools such as questionnaires that have been adapted to the method used.

5) Questionnaire design: The questionnaire is designed to obtain the criteria that will be considered in determining the feasibility of plantation companies as business partners who become guarantor's smallholders in developing oil palm plantations.

6) *Data processing:* Processing of questionnaire data using Fuzzy Analytical Hierarchy Process. The result is a funding priority eligibility criteria will be input in the establishment of the rule base of the Fuzzy Inference System (FIS).

This method is used for determination of eligibility criteria or factors to become a partner is a very complex decision. Fuzzy system is structured numerical estimators and dynamic with the ability to develop intelligent systems in conditions of uncertainty and imprecise [12]. Additionally FAHP method is able to overcome the problems that are qualitative, sometimes confusing, so it will be more objective decision-making and higher consistency [9]. FAHP processing begins by representing the responses of the expert into a fuzzy matrix, then based on the value of fuzzy sets of assumptions used were obtained Triangular Fuzzy Number for each value of the fuzzy results of the questionnaire, further specified matrix crisp.

V. RESULTS AND DISCUSSION

Analysis of the fuzzy approach provides hierarchical weighting on the eligibility criteria of analysis of financing the revitalization of plantations. Weighting sub criteria give priority every aspect of election feasibility business partners in an effort to optimize the process of banking financing analysis.

The criteria of Business Outlook is the banking industry's perception of palm oil which is adapted from a formal Government, association data, data media, opinion leaders, and others. These criteria are very subjective, but the main criteria into consideration banking to bring up his confidence a huge bank continued a process of analysis of the financing of the palm oil plantation Revitalization program.

Results from Fuzzy AHP found the order of assessment priority is Business Outlook, Juridical Aspects, Collateral Aspects, Financial Aspects, Management Aspects, Marketing Aspects and the last is Technical Aspects. From all sub-criterion is found the highest is Business Outlook, Legality of business licencing, Company business ecperience, Land suitability, Qualitas seeds, Market

TABLE I
PRIORITY CRITERIA AND SUB CRITERIA

No	Descriptions	Symbols	Wight	Priority	Consistency
Criteria					
1	Business Outlook		0,3380	1	0.0560
2	Juridical Aspects		0.2901	2	
3	Management Aspects		0.0874	5	
4	Technical Aspects		0.0428	7	
5	Marketing Aspects		0.0492	6	
6	Financial Aspects		0.0946	4	
7	Collateral Aspects		0.0979	3	
Sub Criteria Business Outlook					
1	Business Outlook	BO	1	1	
Sub Criteria Juridical Aspect					
1	Application Legality	LS	0.1204	3	0.0521
2	Legality of business establishment	LP	0.1374	2	
3	Legality of business licencing	LPU	0.7423	1	
Sub Criteria Management Aspects					
1	Company business experience	PUI	0.7183	1	0.0560
2	Cooperative business experience	PUK	0.0892	3	
3	Assesment of management principle	PPM	0.1925	2	
Sub Criteria Technical Aspects					
1	Completeness fasilities production	KSP	0.0832	3	0.0500
2	Land suitability	KL	0.5460	1	
3	Quality of seeds	KB	0.3166	3	
4	Environmental quality	KLG	0.0542	4	
Sub Criteria Marketing Aspects					
1	Facilities production	SP	0.1056	3	0.0826
2	Market opportunities	PP	0.7641	1	
3	Target market	TP	0.1303	2	
Sub Criteria Financial Aspects					
1	Liquidity	LKD	0.3666	2	0.0580
2	Profitability	PRF	0.4366	1	
3	Activity	AKT	0.0462	4	
4	Solvency	SOL	0.1506	3	
Sub Criteria Collateral Aspects					
1	Collateral value	NA	0.1032	2	
2	Collateral legality	LA	0.8968	1	

TABLE 2
FUNCTION AND CHARACTERISTICS OF MEMBERSHIP CRITERIA AND SUB CRITERIA

Criteria	Sub Criteria	Membership Function	Characteristics
Business Outlook	Business Outlook	[price rise, price down]	Prices rise: description a rise in the price of palm oil based on associations, government data, media, key persons, etc.
Marketing Aspects	Facilities production	[available,not available]	Available: have CPO tank stock, position CPO close to the port, appropriate of marketing and transportation staff, joint marketing Office.
	Market Opportunities	[good, not good]	Good: world and local CPO demand is higher than the number or capacity of the existing cpo producers.
	Target market	[exist, not exist]	Ada (Exist): have clear target of marketing
Management Aspects	Company business experience	[enough, less]	Enough: experienced more than one (1) period for planting palm oil plantations (>25 years)
	Cooperative business experience	[enough, less]	Enough: experienced more than one (1) term maintenance of cooperative
	Assesment of management principle	[clearly reflected, not clearly reflected]	Clearly reflected: have a complete organizational structure, the division of labor is clear and professional, reliable officers.
Financial Aspect	Likuidity	[liquid, not liquid]	Liquid: CR>1, it means could fulfill short term obligations
	Profitability	[good, not good]	Good: compared to similar business are equal to or above the average company profits
	Ativity	[well, not well]	Well: turn over assets equal to or smaller than the inkind business
	Solvency	[little debt,lots of debt]	
Collateral Aspects	Collateral value	[cover,not cover]	Cover: collateral worth more than 100% of the value of its credit
	Collateral legality	[certificate, not certificate]	Certificate: proof of land ownership on behalf of the debtor
Technical Aspects	Completeness facilities production	[complete, not complete]	Complete: 6M completed (man, machine, market, material,money, method) tersedia
	Land suitability	[match, not match]	Match: S3 minimal land quality
	Quality seeds	[certificate, not certificate]	Certificate: a certificate issued by the certifier oil palm seeds
	Environmental quality	[supporting, not supporting]	Supporting: the rainfall and heights from sea surface to palm oil
Juridical Aspects	Application legality	[legitimate, not legitimate]	Legitimate: signed by or authorized administrators
	Legality of business establishment	[complete, not complete]	Ccomplete :certificate of incorporation has been approved by the authorities
	Legality of business licencing	[complete, not complete]	Complete: all of the following letters should be valid for (IUP=Ijin Usaha Perkebunan, TDP=Tanda Daftar Perusahaan, SIUP=Surat Ijin Usaha Perdagangan Industri, SITU=Surat Ijin Tempat Usaha)

opportunities, Likuidity, Profitability and Collateral legality. The priority of each criteria and sub criteria can be seen in Table 1. Sub criterion with eigenvalues (weights) to be input Fuzzy Inference System using IF THEN rule base is based on the knowledge base of expert system. Input and output variables feasibility assessment is shown in Figure 2.

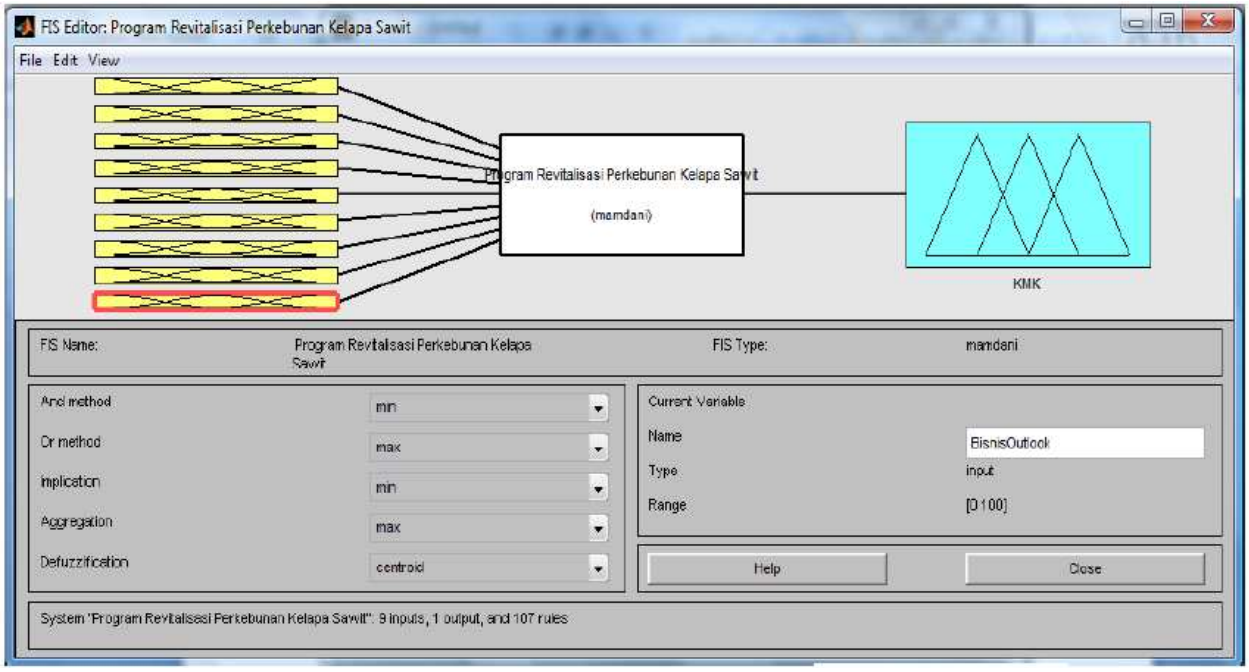

Fig. 2 Variable input and output of banking financing feasibility assessment

From processing with Mathlab found if the plantation company made a petition to get credit Revitalizing Oil Palm Plantations, banks as responsible for determining the feasibility of plantation companies will choose based on 7 criteria, with 20 sub-criteria.

Based on IF-THEN Rule, 20 sub-criteria will result in 1,048,576 combinations. Creditworthiness assessment effort is made to partners in sub-criteria which has the highest level of importance based on the opinion of experts from the banking and plantation. Based on expert opinion, there are 9 sub-criteria, the most important is Bisnis Outlook, Legalitas Perizinan Usaha, Pengalaman Usaha Inti, Kesesuaian Lahan, Kualitas Bibit, Peluang Pasar, Likuiditas, Profitabilitas dan Legalitas Agunan. Verify the rule shown in the following Figure 4:

1. If the price of Business Outlook drops and Licensing legality complete and Business experience enough and Land Suitability appropriate and Seed quality is not certified and Good Market Opportunity and Liquidity is not liquid and good profitability and Legality Collateral Certificate then Getting Credit worthiness is not feasible.

2. If the price rise Business Outlook and Legality of Business Licencing complete and Company Business Experience enough and Land Suitability appropriate and certified Seed Quality and good Market Opportunity and Liquidity liquid and good Profitability and Legality Collateral certificate then Getting Credit worthiness is feasible.

3. If the price rise Business Outlook and Legality of Business Licencing complete and Company Business Experience not enough and Land Suitability approriate and Seed Quality is not certified and good Market opportunity and Liquidity liquid and good Profitability and Legality Collateral is not certified then Getting Credit worthiness is feasible.

4. If the price rise Business Outlook and Licensing legality complete and Business experience enough and Land Suitability appropriate and Seed quality is not certified and Good Market Opportunity and Liquidity is not liquid and good profitability and Collateral legality certified then Getting Credit worthiness is not feasible.

5. If the price rise Business Outlook and Licensing legality complete and Business experience enough and Land suitability is not appropriate and Certified seed quality and Good Market Opportunity and liquidity liquid and good profitability and Legality Collateral Certificate then Getting Credit Eligibility is not feasible.

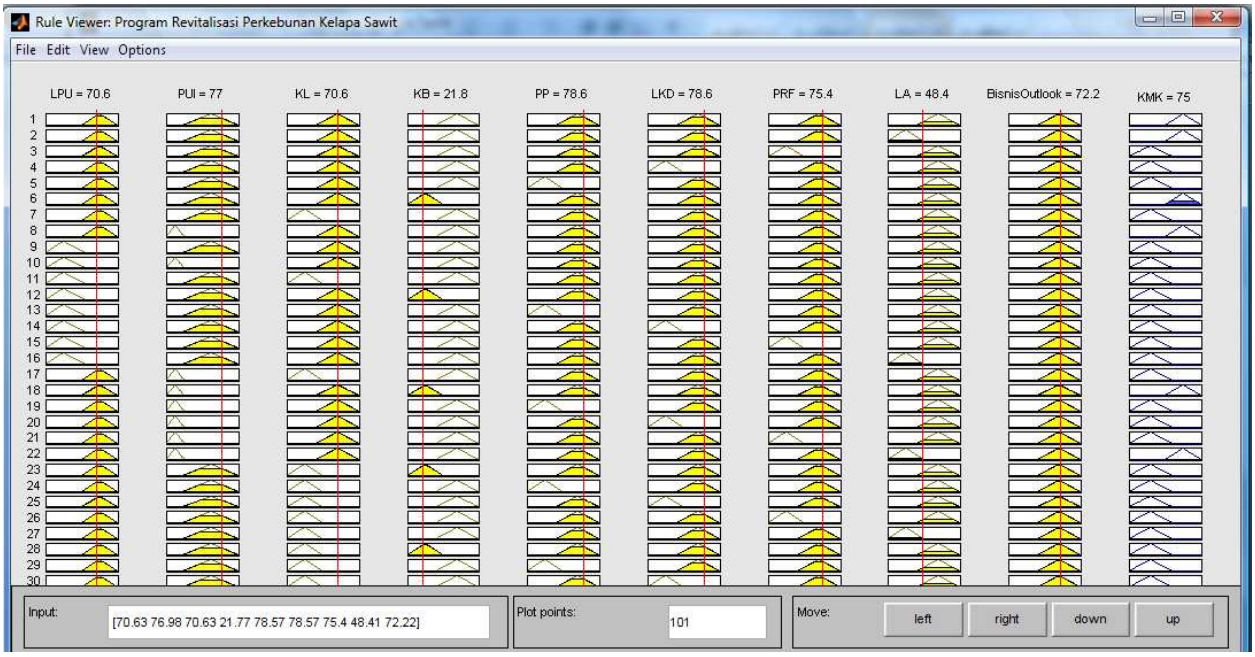

Fig. 3 The verification rule

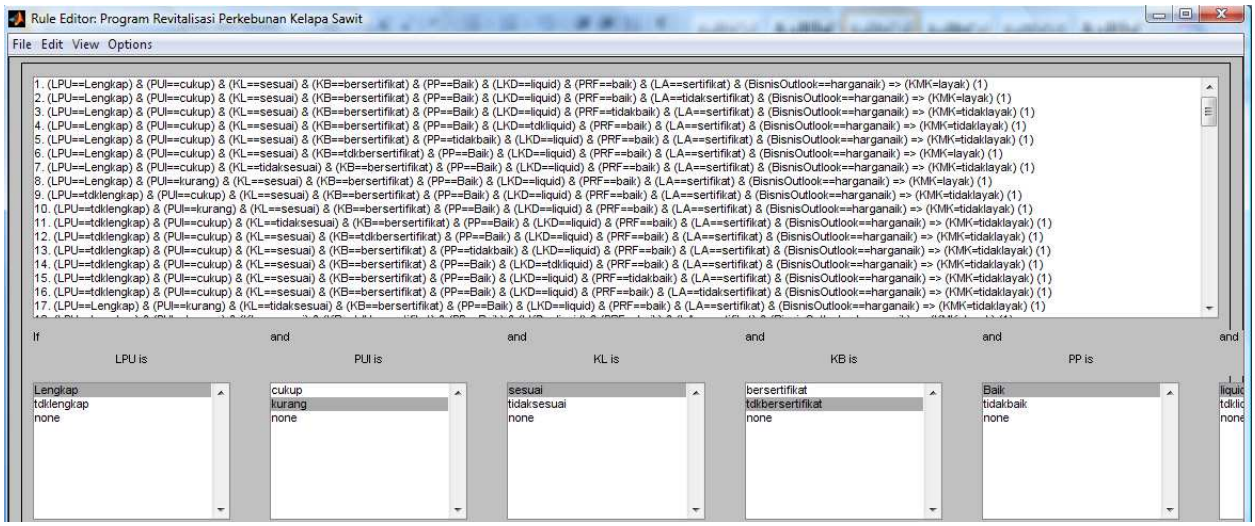

Fig. 4 The Rule Editor

VI. CONCLUSION AND DISCUSSION

1. Fuzzy logic method is used to optimize the analysis of the feasibility of bank financing to farmers through a palm oil plantation company as guarantor and business partners.

2. Fuzzy AHP provides consistency than traditional AHP, because judgment using linguistic variables that are able to make an objective assessment results and address issues that are qualitative.

3. Fuzzy Inference System formulating the mapping input to output using fuzzy logic. FIS is a system of reasoning with the principle of human reasoning which uses his instincts were, so the most easily to understand.

4. Based on expert opinion, from 20 sub-criteria assessment there are 9 very important, namely Business Outlook, Legality Business Licencing, Company Business Experience, Land Suitability, Quality Seeds, Marketing Opportunities, Liquidity, Profitability dan Collateral Legality.

5. Business Outlook as the perception of banks to plantations and oil palm industries based on formal Governments, associations, media, data and opinions are very subjective, but it is a major banking criteria in consideration of his beliefs to bring up the bank continued a process of analysis of the financing partner in revitalizing the plantations.

6. The results showed that not only financial but also performance non-financial eligibility must be taken into account in determining financing plantations as the revitalization of the estate.

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