

# ANALYSIS OF MONITORING INFORMATION SYSTEM FOR PRODUCTION FACILITIES SUPPORT AND AGRICULTURAL BUSINESS CAPITAL

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## ABSTRACT

The results of the analysis of the running system shows that the problems faced by the organization today is tracking of realization and development information for the aid of production facilities and capital of agricultural business that has not been optimal. The purpose of this study is to analyse the needs of systems that support the implementation of aid monitoring. The information system of monitoring and evaluation of production facilities is considered to be the most appropriate to implement the strategy, as well as to overcome the problems occurring in the Ministry of Agriculture in relation to monitoring and evaluation of production facilities and agricultural business capital. The information system of monitoring and evaluation of production facilities and agricultural capital is an internet-based system to facilitate the Central Team (Minister of Agriculture and Technical Team of Directorate General), Provincial Agriculture Development Team, and Technical Team of Regency or Municipality Agriculture Office to access realization and development information for accurate agricultural business aid without being limited by space and time.

**Keywords:** *Information, System, Monitoring, Evaluation, .*

## 1. INTRODUCTION

The rapid development of information technology has affecting human life in various fields. Stated by [1], usage of technology has been penetrated various aspect of our lives. according to [1], in field of higher learning, Information Technology has been evolved from traditional methods to integrated hybrid method in various institution. Related with Information Technology (IT), Information Systems involved Information Technology such as computer, software, database, communication systems, internet to perform specific task [2]. In defining Information System (IS), [2] found that there are four conceptualizations of information system, they are a technology view, a social view, a socio-technical view and a process view. [1] discuss about perception of information technology that become one of the important things to implements a new system, where perception of IT is the process of acceptance by user on new technology forms for specific purposes.

One of the benefits of information technology is to disseminate information. With utilizing computer network, information dissemination can be done easily. In addition, information dissemination can also be done globally with a very large computer network, known as the internet. Through the internet, information can be delivered to all corners of the world. According to [3], Electronic information system is a distributed system that work to organize resources, process information and support business activities of the company.

By utilizing the internet, a company can send information to branch offices located far away, easily and quickly even if it is in same province or difference provinces. Not just easy and fast, the use of the Internet can reduce the company's operating costs. It is used thoroughly by every government department in carrying out its duties. As new system developed needs expertise in several domains [4], after the systems developed, every stakeholder must have willingness to use it to support the organization. Refer to [5], on their research about Monitoring and Evaluation Systems

stated that the role of monitoring and evaluation systems increased globally in latest decades, precisely for improving development interventions. [5] further say that to enhance transparency, effectiveness and efficiency, many organization weathers international or regional uses tools provided by Monitoring and Evaluation System. Beside agricultural field, monitoring and evaluation can be implemented in different area such as Non-Government Organization. [6] on their research say that to improve the effectiveness of their intervention, organization can strengthen their monitoring and evaluation systems. Further [6] stated that the success of projects by non-government organization that has main goal to improve the lives of its citizen, depend on the monitoring and evaluation of the project. To gain good benefits from monitoring and evaluation, [6] stated that Monitoring & Evaluation plans should be documented during and shared between all stakeholders.

Another example of use of monitoring and evaluation showed by [7] where they develop a monitoring and evaluation system to enhanced Local Economic Development Outcomes in South Africa. And stated in Agriculture, farmers always seeking information, communicating with each other and share knowledge of new agriculture technologies [8]. In their conclusion, [8] found that use of ICT is influenced by the nature of business with respect to types of crops grown, information needs and infrastructure. In another part of the world, China's agriculture sector has been developed from traditional to modern practice through the deployment of information and communication technology in the past decades [9]. They found Seven ICT-based information dissemination models are identified and discussed, as before they also stated that Information processing and dissemination have played a critical role in the transformation of China's agriculture sector.

The Ministry of Agriculture is one of the government-owned departments with the task of assisting the President in organizing some government affairs in agriculture. The Ministry has several branch offices in the region. These branch offices use facilities such as e-mail, chat, and phone in communications with headquarters. Currently, the Ministry of Agriculture wants to establish lines of communication between offices branches in the area and the headquarters through the internet, especially in terms of coordination to get it quicker and more efficient.

In the current era of reformation, development in the agricultural sector occupies the highest priority of development in national economic development. The position of the agricultural sector in national economic development is quite real, referred by its proportion to national income. Refer to [3], to optimize business information flow with respect to related processes of information collecting, transferring, feedback and control in the light of new situation and requirements.

Agricultural information system can influence agricultural production and productivity in different ways [10]. For example, in Ethiopia as a developing country, Agricultural is a backbone where the government has planned different strategies to improve the sector. [10] further stated that to improve the current agricultural information system there is a need to understand the source, availability and use of agricultural information. Related with the Agriculture in Indonesia, it is required to have application that support monitoring and evaluation of the subsidy process (MONEV) to farmers. Currently the process is still being carried out conventionally, so it takes a long time to verify and it is difficult to control whether the aid has been properly utilized and how the development of production facilities aid that has been provided. This project is expected to assist the Department of Agriculture in conducting MONEV efficiently and effectively. Besides, there is no data integration between regency, central, and province in conducting MONEV of The Aid of Production Facilities and Venture Capital.

Regarding the importance of Monitoring and Evaluation process in supporting the government's activities in terms of distribution of support in the agricultural sector, therefore it is necessary to do Analysis of Monitoring Information System for Production Facilities Support and Agricultural Business Capital. With this monitoring and evaluation system, hopefully the process of channelling the production facilities support and capital of agricultural business and also the development of agricultural business can be monitored and evaluated more better.

The purpose of this research is to determine the main factors of information system needs in the whole section related to the development of information system in agriculture, and analyse the complex problems related to the selection of information system model at PUSDATIN (Center for Data and Information) of the Ministry of Agriculture of the Republic of Indonesia through the distribution of observed objects into groups of a smaller group using the Analytical Hierarchy

Process (AHP) method. AHP helps the decision of the people who will decide the problem by taking a hierarchical structure evaluation, opinions, experiences and all information about this problem [11]. Further [11] stated that AHP enables forecasting and decision-making by creating a hierarchical flexible structure about the problem that will be decided. One of the implementations of AHP can be seen in helping project management team to select the right contractor that is most likely deliver satisfactory outcomes [12]. On their research, [12] use questionnaires to determined significance of contractor selection criteria that previously identified. [12] claimed that their research contributes on extends the understanding of selection criteria to include degrees of importance and also contribute to implements new method for analysing and selecting the best contractor through multi-criteria AHP approach.

## 2. METHOD

The literature study aims to obtain secondary data, by searching and collecting data and information relating to the topics raised in this study. This data and information is obtained through literature study by studying and reading literature, scientific journals, and other media to obtain theoretical and scientific information that will serve as guidance in the design of Monitoring and Evaluation Information System. The field research aims to obtain primary data, namely data collected directly from the object, by visiting the Center for Data and Information Ministry of Agriculture of Indonesia, B2P2TP Bogor, and Agriculture Department Karawang regency. And AHP method to determine the main factors of information system needs related to the selection of agricultural information system model. The process of hierarchical analysis model is easily usable, highly flexible due to social and economic behaviour changes and quite quick in decision-making [11].

## 3. RESULTS AND DISCUSSION

Based on interviews with heads and staff of Center for Data and Information Ministry of Agriculture, Head and staff of B2P2TP evaluation section, the problems identified are:

1. The difficulties that faced by central and provincial governments in monitoring transactions of distribution of agricultural

production facilities and agriculture business capital for various allocated agricultural support programs, as well as transactions of agriculture business development that occurred on regency/city agriculture district rapidly. This is due to the flow of reporting flowing from the Regency / City, to the provinces, and to the central government still manually implemented with a tiered reporting pattern.

The time required by the District / municipal Agricultural Office to process data for the recapitulation of the required quarterly report is sufficiently long, that is 15 days after the report is received from Gapoktan (Union of Group of farmers). This is because the report recapitulation process is still done manually. The time required by the Provincial Agriculture Office to process the data for the recapitulation of the required quarterly report is sufficiently long, that is 30 days since the report is received from the District Agriculture Office, due to lack of data integration. The time required by the central government to process data for the recapitulation of the required quarterly report is quite long, that is 60 days after the report is received from the Provincial Agriculture Office, due to lack of data integration. The time required by the central government to verify the reporting of production facilities and agricultural capital is long enough, that is 60 days (data flow from the district / municipal agricultural service, forwarded to the provincial agricultural service, and then to the central government) due to the tiered reporting pattern done manually. So, the total time required for quarterly reporting and verification of agricultural support is 5 months 15 days.

2. The difficulty of searching and tracing information to the production facilities support and venture capital that has been realised. This is because information obtained by the central and provincial governments based on paper, making it difficult to drill down from existing information, related to the realization and development of agribusiness.
3. Reporting the realization and development of agricultural business for agricultural support that has been allocated by the government has not been implemented optimally, because there is no standard in the format of reporting of production facilities support and agricultural business capital, so there is often uniformity of

format that slows the process of report recapitulation.

The central government (Ministry of Agriculture of the Republic of Indonesia) is difficult to know the status of realization and utilization of production facilities support or capital of agricultural business that has been allocated, in addition, the central government is difficult to know the problems at the operational level (Regency / City), because there is no comprehensive tools in monitoring and evaluation

The following is the result of discussion and brainstorming with staff of Information System Development Division of Data and Information Centre of the Department of Agriculture of RI to analyse the information system needs of monitoring and evaluation of production facilities and capital of agricultural business:

1. Constraints in the process of monitoring and evaluation of production facilities support and capital of agricultural business are:
    - a. Realization report and development of production and capital of agricultural business cannot be known in real time.
    - b. Difficult to search and trace information to the production facilities support and capital of agricultural business that has been realized.
  2. Implementation of information system of monitoring and evaluation of production facilities support and capital of agricultural business.
    - a. The monitoring and evaluation information system is expected to assist in knowing the realization of support, the development of agriculture business, and the problems that occur at the operational level related to the production facilities and the agricultural business capital.
    - b. Monitoring and evaluation process are more practical and faster.
  3. Recommended features in Monitoring and Evaluation Information System include:
    - a. Recording on the realization data of production facility support and agricultural business capital that can be adjusted with the support program contained in the Ministry of Agriculture.
    - b. The development of agribusiness for each Gapoktan (in tabular form).
    - c. The recording of operational issues related to the production facilities and capital of agricultural business in the Regency / City agricultural office.
- d. Actual variance between plans with support allocation and between support allocation with realization of support use.
  - e. The productivity of each Gapoktan after support is realized.

#### **Alternative Information System Model to be developed**

Alternative model of information system of monitoring and evaluation of production facilities support and agricultural business capital which will be developed as follows:

##### **1. Model 1: Web-based application (e-form)**

This information system model by using electronic form made based on web. To record the transactions of each user (district agricultural service / City) must be connected to the Internet network. Each transaction will be stored in real-time on the webserver. This information system model such as PUAP SIM located at the Ministry of Agriculture

##### **2. Model 2: Desktop application and sending data / information via website (Upload)**

This is model of information system by using a desktop application that requires the application program installation process. Each user (regency / municipal agricultural service) is required to download the application program and directly install the application program on each PC. And then the transaction file generated by the desktop application will be sent (uploaded) through the website. This information system model such as the Monitoring and Evaluation System for Activity Reporting for each work unit contained in the Ministry of Agriculture.

In the selection of information system model of monitoring and evaluation of production facilities and capital of agricultural business that will be developed used the concept of Analytical Hierarchy Process (AHP) with the help of Expert Choice 2000 software. The determination of criteria for the selection of information systems is based on data system development guidance and information scope of the Ministry Agriculture. The criteria are: Potential Development, Costs, Bureaucratic Procedures, Supervision Pattern, Effectiveness, Professionalism, and Security. From several criteria can be formed hierarchical structure in the selection of agricultural information systems and statistics as follows (Figure 1):

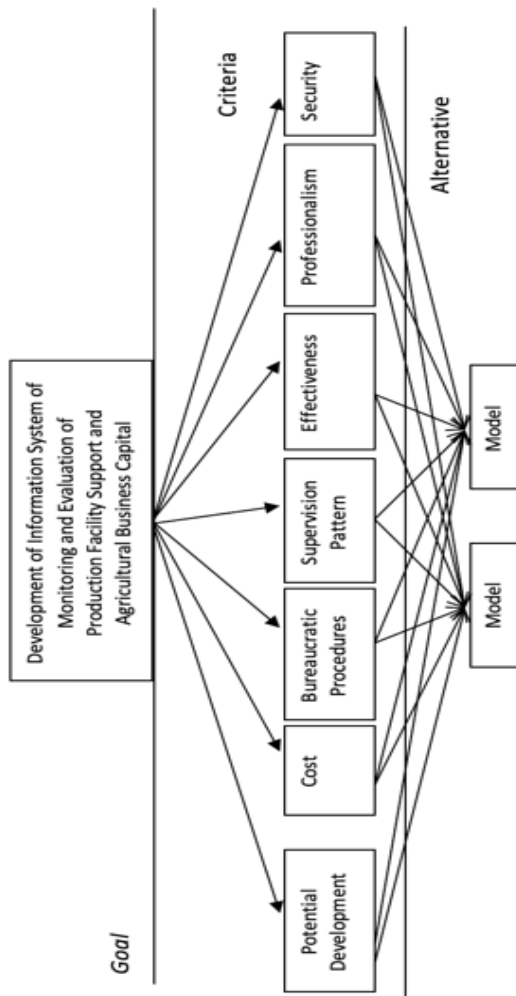


Figure 1. Hierarchical Structure

Annotation:

Model 1 = web-based application (*e-form*)

Model 2 = desktop application and information delivery via website (*upload*)

From the result using Expert Choice 2000 software obtained weights for each of the following criteria (Table 1):

Table 1. Weighting Criteria for Goals

Criteria	Weight
Potential Development	0,080
Cost	0,038
Bureaucratic Procedure	0,228
Supervision Pattern	0,300
Effectiveness	0,162
Professionalism (time)	0,139
Security	0,052

Inconsistency Ratio = 0,13

Source: Data Processing Result

From the above process, we can obtain the overall weight or aggregate weight of the alternatives to the overall criteria (effectiveness, professionalism, coaching pattern, supervision pattern, cost, potential development, and bureaucratic procedure). The aggregate weight results from each alternative are as follows (Table 2 and Figure 2):

Table 2. Alternative Aggregate Weight

Criteria	Weight
Model 1	0,641
Model 2	0,359

Source: Data Processing Result

Dynamic Sensitivity for nodes below: Goal : Development of Information System of Monitoring and Evaluation of Production Facility Support and Agricultural Business Capital

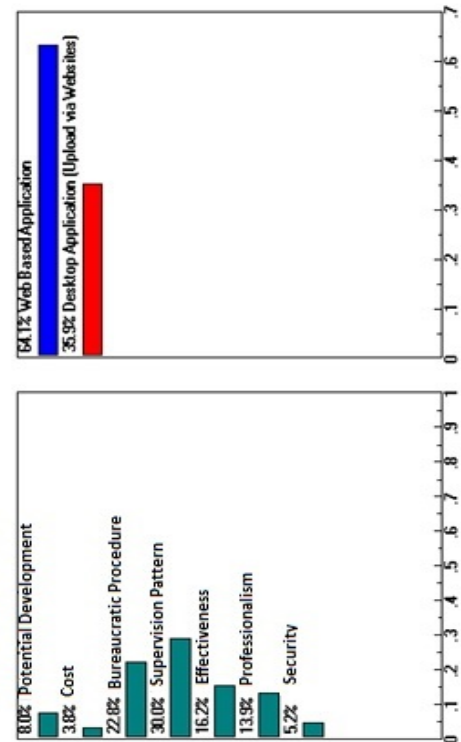


Figure 2. Result of Aggregate Weight

Source: Data Processing Result

Defining Criteria for Goals (Goal)

From the results of data processing obtained the highest weight is the supervision pattern of 0.300. The next greatest weight of bureaucratic procedure criteria is 0.228. The weight of each of the criteria from the largest to the smallest can be seen in Table 3. Overall Alternative Weight (Aggregate). From the results of processing obtained the weight aggregate alternative as in Table 4. From the above processing can be seen that the weight obtained by model 1 that has a value greater than model 2. In this case model 1 has a better preference than



model 1 on all criteria that exists. This is because model 1 is superior to each criterion rather than model 2.

Table 3. Comparison Between Model 1 and Model 2

Information System Development Model			
Rank	Criteria	Model 1	Model 2
1	Supervision Pattern	Frequency of supervision and evaluation can be done periodically with access to information in real time.	Frequency of supervision and evaluation is not done in real time (Batch Processing)
2	Bureaucracy Procedure	Bureaucracy Chain can be shortened (Regency/City → Province → Central Government)	Bureaucracy Chain still work like current procedure, because it needs recapitulation data on province level (Regency/City → province → Central Government)
3	Effectiveness	Communication and information more effective (Online).	Communication and Information is less effective (Batch).
4	Professionalism (time)	Information can be gained (up to date)	Needs time to reconcile the data (not up to date).
5	Potential Development	This system can be integrated with web-based application in agriculture department or other government department.	This system can be integrated with the application of the monitoring and evaluation reporting system (Task Force) located in the district / municipal

6	Security	Data protection is only done on the central government – PUSDATIN, due to data centralization. (Firewall).	agricultural service. Has risk of losing data, because the data is spread geographically.
7	Cost	System maintenance cost is not large (data centralization) - benchmark based on system maintenance cost.	Large system maintenance costs (apps need upgrades if new features are added) - benchmarks based on system maintenance costs of monitoring and evaluation reporting.

Table 4. Information System Analysis Monitoring and Evaluation of Production Facility Support and Agricultural Business Capital based on Criteria on AHP

Rank	Criteria	Weight	Information System Analysis	Solutions
1	Supervision Patterns	0.300	System that can support in terms of supervision of reports in real time and periodically for the production facilities support and agricultural business capital provided by the central government.	Provide adequate facilities of collecting, processing and disseminating agricultural data and information.
2	Bureaucratic Process	0.228	A system that can overcome the length of	Overcoming the low integration between

	dure		bureaucracy procedures / chains of the Regency / City → provinces / central government, with the integration of data in agriculture (particularly in terms of reporting on realization of production facilities and agricultural capital).	functions.		Devel opme nt		integrated with other agricultural databases, with this system can shorten the communication path between the central government and local government with the centralization of data via web-based application.	communicat ion relationships with regions.
3	Effect iveness	0.162	Systems that can support more effective communication and information - online processing (Gapoktan as the recipient of support and the central government as a donor).	Improve response, empathy and assurance in data and information services.	6	Secur ity	0.052	A system that can support synergistic and integrated relationships between central and regional governments (provinces and districts / municipalities) to maintain data security.	Optimizatio n flow of data/informa tion
4	Profe ssion ality (Time )	0.139	Systems that can improve the time-side professional relationship between the central government and stakeholders, related to the implementation of government agricultural support programs.	Improve responsiveness, empathy and assurance in data and information services and standardize data collection methods.	7	Cost	0.038	This system can be implemented with a cost that is not too large, because the availability of infrastructure (hardware, network, software) is quite adequate. In addition, the system maintenance cost is not	Availability of computer networks and information systems.
5	Poten tial	0.080	Systems that can be	Establish structural					

			too large.	
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Based on the analysis of the identified problems, it is proposed an alternative problem solving, namely designing and making information system of monitoring and evaluation of production facility support and agricultural business capital capable to:

1. Making recording of realization and development of agribusiness business of supporting production facilities and capital of agricultural business.
2. Making recording of operational problems and alternative solutions to these problems related to the support of production facilities and agricultural business capital contained in the district / municipal agricultural service.
3. Develop standard reporting format to find out the realization of production facilities support and capital of agricultural business, and the development of agricultural business so that the reporting mechanism can be implemented optimally.
4. Presents a collection of transaction and problem information at the operational level that is useful for monitoring and evaluation process of production facilities and agricultural business capital that can be drill-down and accessed in real time.
5. Perform data processing for the preparation and presentation of reports quickly and easily, supported by data that has been integrated between the District Agriculture Office / City, Provincial Agriculture Office, and the Ministry of Agriculture Center.

Based on the results of requirement analysis, it has obtained the information system to be developed. In carrying out the information system development strategy and agriculture statistics and in accordance with the requirement analysis, the information system development strategy of monitoring and evaluation of production facilities support and agricultural capital is selected to be implemented. The following are the factors that influence the implementation of the strategy:

1. Competent Human Resources

Competent Human Resources is required in the field of administration, information systems and information technology. The human resources need to have a proper understanding of how the work or implementation instructions related to the use of information systems are developed by improving the professionalism of the human resources.

2. Realization of agricultural information network infrastructure at central, provincial, and regency / municipal levels that have good performance.

Development of Information Network Infrastructure is directed to provide computer network system capable of supporting the process of information systems and data exchange in the scope of central, provincial, and district / city. This computer network system must have good performance, including access speed, security, ease of maintenance and ease of development. Innovation of new technology utilization is one of the activities that will be implemented in Information Network Infrastructure Development activities. This activity aims to optimize the utilization of new technology for the improvement of service to society in general and internal scope in particular.

3. Requires support from the Head of Agricultural Data and Information Center (Pusdatin) and other relevant officials.

It requires commitment of the Head of Agricultural Data and Information Center to support statistical activities and information system which is the basic capital that can be used in carrying out its duties and functions. Internal consolidation by providing education and training in the field of statistics and information systems in most of the implementing staff in the scope of the Center of Agricultural Data and Information and at the level of District / Municipality Agricultural Service is a real step in building the competence of executing personnel data processing and statistical activities.

This research will give the lesson learned for the next researcher to do step by step selection process for the system selection using AHP technique. So, the system designer will look more effective to fulfill the user needs and solve the user problems. This research will give the insight also to the next researcher to focus on selection criteria (Potential development, cost, bureaucratic procedures, supervision pattern, effectiveness, professionalism, and security) before they implement the system, especially for the system related the government.

#### 4. CONCLUSION

Based on the result of analysis and design of information system of monitoring and evaluation of production facilities support and capital of this



agriculture business, the conclusion that can be drawn are:

1. Information system model proposed to support information system of monitoring and evaluation of production facility support and capital of agriculture business, that is model of web-based information system (web-based application).
2. From the results of the analysis of the running system is known that there are some problems faced by the Ministry of Agriculture of the Republic of Indonesia related to the monitoring and evaluation of production facilities support and capital of agricultural business, they are:
  - (a) The difficulty of Central Government and Provincial Agricultural Development Team in monitoring the transactions on the distribution of production facilities support and agriculture business capital;
  - (b) The difficulty of searching and tracking information on production facilities support and agricultural capital that has been realized, especially the development of agricultural business for agricultural support that has been allocated by the government;
  - (c) It is difficult to know information on the status of realization and utilization of production facilities support or agricultural capital that has been allocated;
  - (d) It is difficult to know the problems at the site-specific operational level.

The design of monitoring and evaluation system for production facilities support and agricultural business capital is the result of the detailed strategy and problem analysis. The monitoring and evaluation information system designed can provide access to information appropriate to the needs of each party involved in monitoring and evaluation of production facilities support and agriculture business capital at ex-ante, on-going and ex-post stages to facilitate administrative activities and improve the performance of the Central Government (Ministry of Agriculture and Technical Team of Directorate General), Provincial Agriculture Development Team, and Technical Team of Regency / Municipality Agriculture Service. The next research needs to focus on analysis the user requirement more detail to explore about possibility of user acceptance to use the system.

## APPENDIX

AHP is a process to calculate the number value to rank each alternative decision based on the extent to which the alternative meets the criteria of the decision maker. The general mathematical process

involved in AHP is to set preferences at each level of the hierarchy.

In AHP decision making determines the value or "score" of each alternative for a criterion using pairwise comparison. In pair comparison the decision maker compares two alternatives (that is, a pair) based on a certain criterion and indicates a preference. This comparison is done using a preference scale (preference scale), which gives a numeric number for each level of preference.

The preference scale standard used by AHP has been determined by researchers who are experienced in the AHP field to be used as a reasonable basis in comparing two items or two alternatives. Each level on the scale is based on a comparison of two items.

The following is a summary of the mathematical stages used to make decision recommendations based on AHP:

1. Develop a pair comparison matrix for each alternative decision (location) based on each criterion.
2. Synthesis:
  - Add up the values in each column in the pair comparison matrix.
  - Dividing the value of each column in the pair comparison matrix by the number of columns concerned is called the normalization matrix.
  - Calculate the average value of rows in the normalization matrix called the preference vector.
  - Combine the preference vectors for criteria (from step 2c) into a preference matrix that shows preferences for each location based on each criterion.
3. Make a pair comparison matrix for the criteria.
4. Calculate the normalized matrix by dividing each value in each column of the matrix by the number of related columns.
5. Make a preference vector by calculating the average row in the normalization matrix.
6. Calculate the overall score for each alternative decision by multiplying the criteria preference vector (from step 5) with the criteria matrix (from step 2d).
7. Alternative decision ranking based on alternative values calculated in step 6.

The figure shows the questionnaire for AHP.

**Questionnaire of Analytic Hierarchy Process (AHP)**

We ask you fill it objectively and correctly, because this questionnaire is for res project with scientific objectives so the valid and accurate data is needed. Thank yc your help and cooperation.

**Purpose (Goal):** Development of Monitoring and Evaluation Information Sy Assistance in Production Facilities and Agricultural Business Capital

**Criteria:**

- A: Potential for development
- B: Cost
- C: Bureaucratic procedures
- D: Pattern of supervision
- E: Effectiveness
- F: Professionalism (time)
- G: Security

**Alternative:**

- Model 1 = Web-based application (e-form)
- Model 2 = Desktop application and sending information via website (Upload)

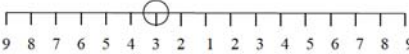
**Information:**

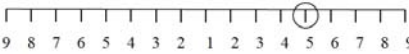
- Scale 1 = If choice 1 as important as choice 2.
- Scale 3 = If choice 1 significantly more important than choice 2.
- Scale 5 = If choice 1 is more important than choice 2.
- Scale 7 = If choice 1 is absolutely more important than choice 2.
- Scale 9 = If choice 1 is exceptionally more important than choice 2.

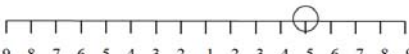
Scale 2, 4, 6, and 8 = Middle value between 2 adjacent decision values.

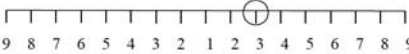
Please fill in the circle according to the scale.

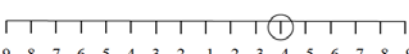
**Comparison between Criteria:**

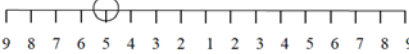
A  B

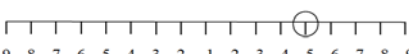
A  C

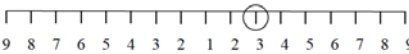
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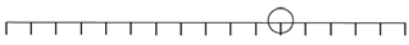
A  E

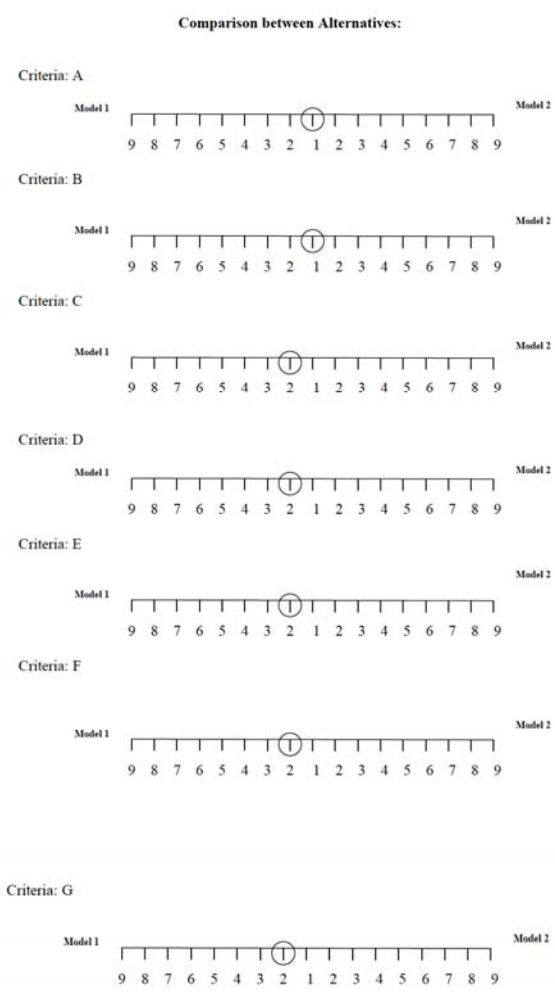
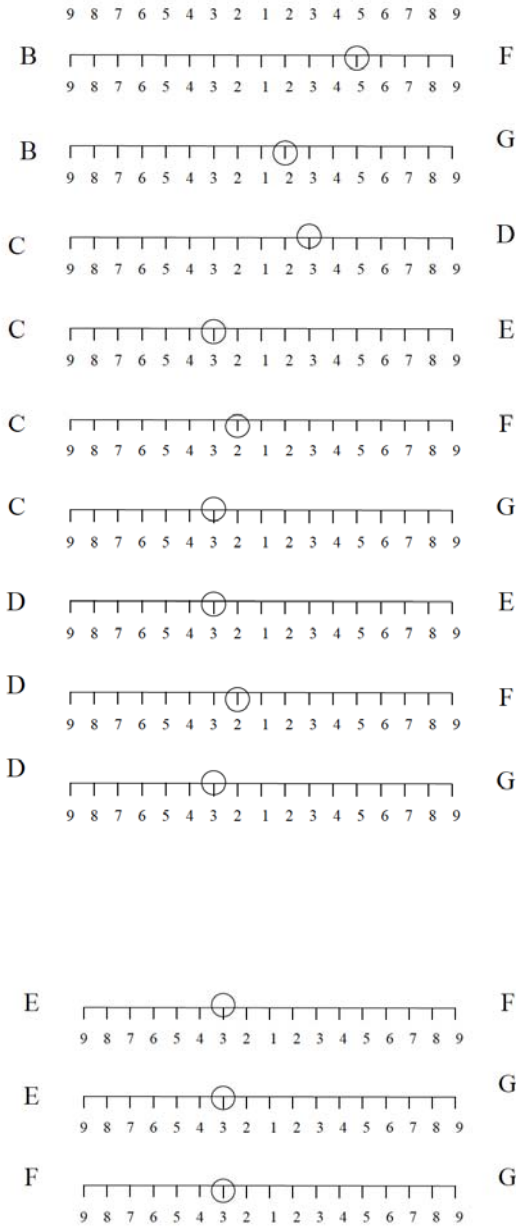
A  F

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B  C

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B  E



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**REFERENCES:**

[1] L. W. Leong and O. Ibrahim, "Role of Information System (IS), Social Networking Technology (SNT) and Web 2.0 for Improving Learning Outcomes: A case of Malaysian Universities", *2nd Global Conference on Business and Social Science - 2015*, GCBSS-2015.

- [2] S. K. Boel and D C.Kecmanovic, "What is an Information System?", 2015 48th Hawaii International Conference on System Sciences.
- [3] X. Li, "The intelligent technologies of electronic information system", *IOP Conf. Series: Journal of Physics: Conf. Series*, 887, 2017.
- [4] J. Livari, "Information system artefact or information system application: that is the question", *Information Systems Journal*, 2016.
- [5] S. Rossignoli, F. Coticchia and A. Mezzasalma, "A Critical Friend: Monitoring and Evaluation Systems, Development Cooperation and Local Government. The Case of Tuscany", *Evaluation and Program Planning*, 2015.
- [6] N. J. Micah and S. W. Lukerto, Dr, "Monitoring and Evaluation Systems and Performance of Non-Governmental Based Maternal Health Projects in Bungoma South Sub-County, Kenya", *European Scientific Journal* August 2017 edition Vol.13, No.23, 2017.
- [7] I.G. Govender, "Development Monitoring and Evaluation Systems Enhancing Local Economic Development Outcomes in South Africa", *The Anthropologist*, 28:1-2, 19-29.
- [8] D. Odongo, "Agricultural Information Access Among Smallholder Farmers: Comparative Assessment of Peri-Urban and Rural Settings in Kenya", *Agricultural Information Worldwide*, Vol. 6, 2013/2014.
- [9] Y. Zhang, L. Wang and Y. Duan, "Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China", *Information Processing in Agriculture*, 2016.
- [10] B. Limenih, "Agricultural knowledge, source and information system in central highland of Ethiopia", *Journal of Agricultural Extension and Rural Development*, Vol.10, No. 2, pp. 28-34, February 2018.
- [11] A. Galo, "Analytical Hierarchy Process as a Decision-Making Model", *European Journal of Multidisciplinary Studies*, Jan-Apr, 2017, Vol. 4, No. 2.
- [12] M. Balubaid and R. Alamoudi, "Application of the Analytical Hierarchy Process (AHP) to Multi-Criteria Analysis for Contractor Selection", *American Journal of Industrial and Business Management*, 2015, 5, pp. 581-589.