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GROUP DECISION SUPPORT SYSTEM MODEL TO DETERMINE PROSPECTIVE PARTICIPANTS FOR LECTURER STRENGTHENING ACTIVITIES

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ABSTRACT

Sriwijaya State Polytechnic is one of the state vocational universities in Indonesia which plays an important role in producing alumni with adequate expertise. Efforts are being made to achieve this goal through increasing the competence of lecturers in the Higher Education environment. The program is realized by carrying out lecturer strengthening activities which are divided into 5 activities, namely 1) assignment research, 2) assignment service, 3) workshops and training, 4) competency certification, and 5) industrial internship. This study aims to build a model group decision support system (GDSS) for management in universities to determine lecturers who will participate in lecturer strengthening activities. The method used is a combination of Multifactor Evaluation Process (MFEP) and Borda. The MFEP method is used to generate recommendations from each decision maker independently, while the Borda method is used to perform aggregation and final ranking of the recommended alternatives. In this built GDSS model, there are 8 criteria and 20 alternatives involved in testing the proposed model. The results of this study can be used by management in universities in group decision making, and as a research model in group decision support systems.

Keywords: *Group Decision Support System (GDSS), Multifactor Evaluation Process (MFEP), Borda.*

1. INTRODUCTION

Sriwijaya State Polytechnic as one of the state universities in the Sumatra-Indonesia region has a strategic role as a vocational college that emphasizes the expertise aspect. Since 2015, this polytechnic has organized Lecturer strengthening activities in order to improve Lecturer performance in the Tridharma Higher Education activities which include teaching, research, and community service as well as supporting elements such as workshops and training.

Universities must have a strategy to improve their performance so that they can compete with other universities. Aspects of internal management & organization, academic atmosphere, and university competitive sustainability are some of the factors considered in strategic management [11]

Decision making is one of the most widely used management processes to deal with real world problems which are usually characterized by complex and difficult tasks [10]. Complex decision making can be easily implemented using computer-based information systems.

Management in an organization is rarely able to solve problems independently. Various parties and certain levels of management in this case need to be involved in solving various organizational problems. This indicates the need for an approach to problem solving and group decision making. Group Decision Support System (GDSS) is a computer-based interactive system that facilitates and provides solutions for group decision making [12].

Various studies on the topic of the Group Decision Support System (GDSS) have been carried out, including research on the selection of electricians using multi-attribute decision making and triangular fuzzy numbers [14]. The parameters used in the GDSS are test result variables, which consist of 4 types, includes written test, theoretical knowledge, practice knowledge, and oral test. This developed model has succeeded in ranking the

alternative electrician candidates who have the highest to the lowest values.

Other research on GDSS was also conducted to evaluate Information and Communication Technology (ICT) Projects using a hybrid method, including the Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Copeland Score [15]. In this case, the AHP method is used to generate the value of the criteria used as input and the calculation process in TOPSIS. The calculation results from TOPSIS will then be the basis for ranking of each decision maker. Meanwhile, the Copeland method is used to aggregate the rankings of each decision maker so that the best results are obtained.

The GDSS model is also implemented to select the right cloud computing services in the company's business services [16]. This study sets 7 criteria in the selection of alternatives, including cost, adaptability, available IT skills, urgency, security of data, privacy of data, and service reliability. The model used is Multi-Criteria Decision-Making (MCDM) to produce the best ranking of defined alternatives.

GDSS research has been carried out, among others, to determine prioritized areas and leading sectors involving decision makers from government and non-government elements, and experts in academics to jointly provide evaluations [17]. This study uses the Garrett Score to determine the best ranking of independent decision makers.

The Decision Support System can also be combined with a geographic information system (GIS) to map potential recipients of cash waqf so that waqf distribution can reach certain areas and is right on target [18].

The Decision Support System is also implemented using a web-based application to provide dietary food plan recommendations as a guide for decision making in nutritional counseling [19]. This system will thus help a person to achieve the ideal weight, as recommended by dietitians. Calculations and decision-making processes are generated automatically by the developed system. The application of the Fuzzy Analytical Hierarchy Process (FAHP) method in the development of the Decision Support System is used to evaluate 5 big data frameworks using 12 criteria. The use of FAHP aims to improve the quality of the evaluation in the presence of the uncertainty factor [20].

With various models and applications described in this background, this research formulates how to build a group decision support system (GDSS) model and its implementation in GDSS applications. So that it can be used as a tool for collaborative management in universities.

2. LITERATURE REVIEW

2.1 Group Decision Support System (GDSS)

Decision Support System (DSS) is an interactive information system that provides information, modeling, and manipulating data. The system is used to assist decision making in semi-structured and unstructured situations where no one knows exactly how decisions should be made [21]. A DSS application usually consists of several sub-systems including data management sub-systems, model management sub-systems, user interface sub-systems, and knowledge base sub-systems.

According to [1] the Group Decision Support System (GDSS) is used to obtain the optimal solution in a group. GDSS can provide better results compared to decisions made by one decision maker [8]. Each individual has the same right to give preference to each alternative [9]. GDSS is known as the Electronic Meeting System (EMS) or groupware which is a collection of software, hardware, and procedures designed to perform group tasks automatically [13].

This study builds a group decision support system (GDSS) model using the Multifactor Evaluation Process (MFEP) method and is implemented in universities to assist management in determining lecturers who will carry out lecturer strengthening activities. This study emphasizes several criteria that are generally considered for lecturers at universities when they are going to carry out certain kinds of activities.

2.2 Multifactor Evaluation Process (MFEP)

The Multifactor Evaluation Process (MFEP) method is based on a decision-making process that considers several factors. If only a few factors are considered in decision making, then decision making can be done using an intuitive approach. Meanwhile, for the decision-making process that involves several factors (multifactor) an appropriate method is needed [7].

The MFEP method applies several stages as follows [6]:

1. Determine the factor and the weight of the factor, where the total weighting must be worth 1 which is then referred to as the factor weight.

2. Fill in the value for each factor as an objective value (factor evaluation) with a value range between 0 – 1 or 0 – 100.
3. Calculation of weight evaluation is a calculation process between factor weight and factor evaluation, where the sum of all the results of the weight evaluation is hereinafter referred to as the total result of all evaluations.

The formula used in the MFEP method is:

$$TWE = \sum(FW \times FE) \quad (1)$$

Description:

TWE = Total Weight Evaluation
FW = Factor Weight
FE = Factor Evaluation

2.3 Borda Method

The Borda method was discovered by a French mathematician named Jean Charles de Borda in the 18th century [2, 3]. Borda is one of the algorithms for aggregation, which is doing rankings obtained from several decision makers (DM). The Borda method is done by assigning weights to the first, second, and so on ranks. The greatest weight is given to the best ranking of each decision maker (DM). The Borda method is done by giving a ranking to the decision makers (DM) on the chosen alternative, so that alternatives that have the same score will not occur [4].

According to [5] the Borda method is done by giving the highest score to the highest rank of each decision maker (DM). This can be formulated as follows:

$$V_j = \sum_{i=1}^{n} w_{j} * S_{ij} \quad (2)$$

Referring to formula (2), it can be seen that Vj is the total score of the alternative Aj. The largest value of Vj indicates that Aj is the highest rank, while Sij is the score for the rank of Rij.

3. RESEARCH METHOD

3.1 Decision Making Model

Figure 1 is the steps carried out in the system to carry out the GDSS assessment. The initial stage in this process is to determine the alternatives and criteria that will be used in the evaluation and recommendations. This study formulates 8 criteria in which there are sub-criteria to provide more detailed information related to these criteria. A total of 20 alternatives that will later be selected in the recommendation process are then defined.

There are 3 entities in the decision makers in this GDSS, consisting of the head of the department (DM-1), the secretary of the department (DM-2), and the head of the study program (DM-3) according to the scope of work to be completed.

In general, the steps taken are to rank individual decision makers (DMs) using the MFEP method. This stage is continued by aggregating the results that have been carried out by each DM. The final ranking results will then be obtained using the BORDA method. The final result of the GDSS model is in the form of a ranking list of alternatives that have the largest to the smallest borda score weights. The largest borda score indicates that the alternative is highly recommended by the GDSS system and vice versa.

3.2 GDSS Information System Architecture

Figure 2 provides an overview of the design of the GDSS information system used in this study. There are sub-systems of database management and model management which in this study are the MFEP and BORDA methods. In terms of system users, there are users who act as system administrators who have the authority to manage the running of the application, and 3 decision makers consisting of the head of the department, secretary of the department, and head of the study program.

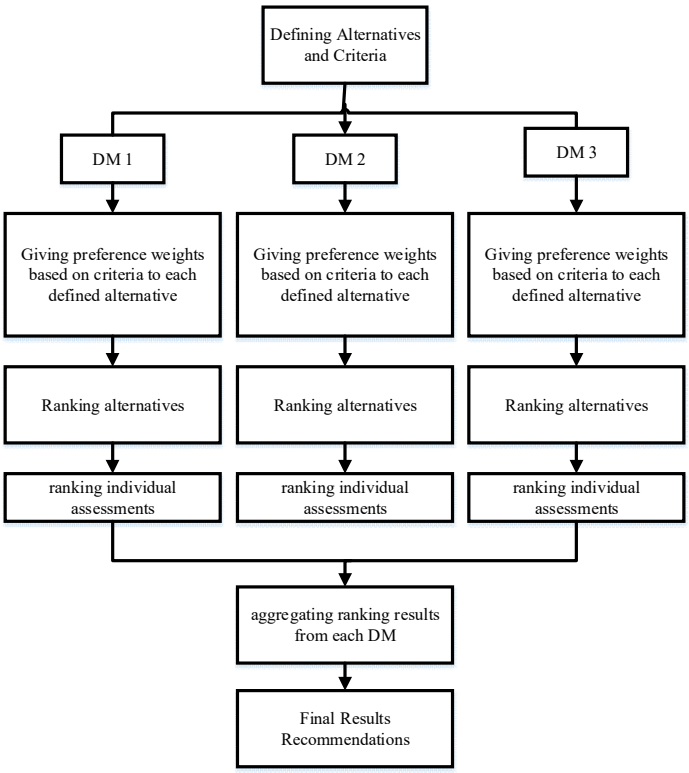

Figure 1: Modeling Step in GDSS

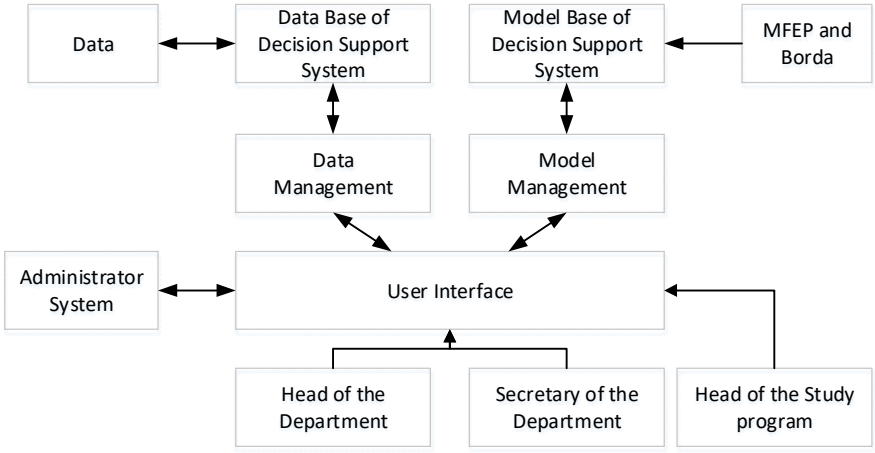

Figure 2: Application Architecture of GDSS

3.3 Value Normalization

Several sub-criteria values used in this developed model utilize normalized values using formula (3). The results of this normalization will produce values with a range of 0 to 1.

$$normalized\ (x) = \frac{x - minValue}{maxValue - minValue} \quad (3)$$

4. RESULTS AND ANALYSIS

4.1 Criteria and Weights

Determination of prospective lecturers who will take part in the Lecturer strengthening program activities is carried out using several criteria and weights as presented in Table 1. In the MFEP algorithm stage, the process that is carried out first is to determine the factors that are considered important which is then continued by giving

weights to the factors used where the total weighting must be equal to 1.

Table 1: Factor Weight

Factor	Factor Weight
C1 – Educational Qualification	0.1
C2 – Functional Position	0.2
C3 – Group Working Period	0.2
C4 – Lecturer Certification	0.1
C5 – Teaching Achievement	0.1
C6 – Research Achievement	0.1
C7 – Service Achievement	0.1
C8 – Supporting Achievement	0.1
Total Factor Weight	1

After the weighting factor has been determined, the next step is to determine the sub-criteria value of each factor as presented in Table 2 to Table 9. The weight value of this sub-criteria is determined using formula (3) as a normalization stage so that a range will be obtained. values from 0 to 1.

Table 2: Criteria Weight Value for C1-Educational Qualification

No.	Criteria	Score	Normalization Value
1.	S2 (Master)	1	0
2.	S3 (Doctor)	2	1

Table 2 is the weight of the sub-criteria for the C1 Education Qualification criteria involving 2 sub-criteria, namely S2 (Master) and S3 (Doctoral) education.

Table 3: Criteria Weight Score for C2-Functional Position

No.	Criteria	Score	Normalization Value
1.	Lecturer	1	0
2.	Expert Assistant	2	0,25
3.	Lector	3	0,50
4.	Associate Professor	4	0,75
5.	Professor	5	1

Functional Position Criteria have 5 sub-criteria as in Table 3 which consists of Lecturers, Expert Assistants, Lectors, Head Lectors, and Professors. The criteria for this functional position have a fairly large criterion weight, which is 0.2 because this criterion is an award for the achievement of the Lecturer's functional position.

Table 4: Criteria Weight Value for C3- Working period by group

No.	Criteria	Score	Normalization Value
1.	0 – 5 years	1	0
2.	6 – 10 years	2	0,25
3.	11 – 15 years	3	0,50
4.	16 – 20 years	4	0,75
5.	> 20 years	5	1

The criteria for work period by group also get a large portion of 0.2 with details of the sub-criteria as presented in Table 4. The working period of the group is grouped into 5 years of service where the longer the tenure of the lecturer, the greater the award given to him.

Table 5: Criteria Weight Score for C4-Lecturer Certification

No.	Criteria	Score	Normalization Value
1.	Not yet have Lecturer Certification	1	0
2.	Already Lecturer Certification	2	1

Lecturer certification criteria are also considered with the assessment criteria as presented in Table 5. Some lecturers do not have Lecturer certification.

Table 6: Criteria weight score for C5-Teaching Achievement

No.	Criteria	Score	Normalization Value
1.	very poor	1	0
2.	poor	2	0,25
3.	enough	3	0,50
4.	good	4	0,75
5.	very good	5	1

The criteria for teaching achievement can be seen in Table 6. This teaching achievement is carried out by looking at the teaching activities carried out by lecturers through track records, such as the percentage of teaching attendance, assessment of teaching quality in class, completeness of teaching materials, and other parameters in the implementation of the teaching process.

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Table 7: Criteria weight value for C6-Research Achievement

No.	Criteria	Score	Normalization Value
1.	very poor	1	0
2.	poor	2	0,25
3.	enough	3	0,50
4.	good	4	0,75
5.	very good	5	1

The research achievement criteria are considered as an award to the Lecturer for the achievements of the research activities that have been carried out. These sub-criteria can be seen in Table 7.

Table 8: Criteria weight value for C7 - service achievement

No.	Criteria	Score	Normalization Value
1.	very poor	1	0
2.	poor	2	0,25
3.	enough	3	0,50
4.	good	4	0,75
5.	very good	5	1

Table 8 is a sub-criteria for awards to lecturers for the achievements of community service activities.

Table 9: Criteria weight value for C8-Supporting Achievement

No.	Criteria	Score	Normalization Value
1.	very poor	1	0
2.	poor	2	0,25
3.	enough	3	0,50
4.	good	4	0,75
5.	very good	5	1

Table 9 is a sub-criteria for awards to lecturers for the achievement of supporting element activities that have been carried out by lecturers.

The weight of the sub-criteria for C5 to C8 is carried out by the decision maker by reviewing some additional information that has been collected before the assessment is carried out. The sub-criteria in C5 to C8 are subjective, although supported by various provided data.

4.2 Alternate Scoring by Decision Makers

Assessments or recommendations are made by decision makers consisting of the Head of the Department (DM-1), the Secretary of the Department (DM-2), and the Head of the Study Program (DM-3). Rating Table by DM-1, DM-2, DM3.

Table 10: Rating Table by DM-1

ID	Factor Evaluation (FE)								Weight Evaluation (WE)								SUM
	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	(WE)
A1	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A2	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A3	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A4	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A5	0,00	0,50	0,50	1,00	0,75	0,75	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,08	0,05	0,05	0,55
A6	0,00	0,50	0,50	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,50
A7	0,00	0,75	0,50	1,00	0,75	0,75	0,50	1,00	0,00	0,15	0,10	0,10	0,08	0,08	0,05	0,10	0,65
A8	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A9	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A10	0,00	0,50	0,75	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,05	0,05	0,05	0,05	0,55
A11	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A12	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A13	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A14	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A15	0,00	0,50	0,50	1,00	0,25	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,03	0,05	0,05	0,05	0,48
A16	1,00	0,50	0,50	0,00	0,75	0,50	0,50	0,50	0,10	0,10	0,10	0,00	0,08	0,05	0,05	0,05	0,53
A17	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A18	0,00	0,50	0,50	1,00	0,75	1,00	1,00	1,00	0,00	0,10	0,10	0,10	0,08	0,10	0,10	0,10	0,68
A19	0,00	0,50	0,00	1,00	1,00	0,50	0,75	1,00	0,00	0,10	0,00	0,10	0,10	0,05	0,08	0,10	0,53
A20	0,00	0,25	0,50	0,00	0,50	0,50	0,50	0,50	0,00	0,05	0,10	0,00	0,05	0,05	0,05	0,05	0,35

Table 10 contains information related to scoring or recommending all alternatives made by the first decision maker (DM-1). Table 11 on the other hand is the result of scoring the alternatives

by the 2nd decision maker (DM-2), and Table 12 is the result of scoring the alternatives by the 3rd decision maker (DM-3).

Table 11: Rating Table by DM-2

ID	Factor Evaluation (FE)								Weight Evaluation (WE)								SUM
	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	(WE)
A1	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A2	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A3	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A4	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A5	0,00	0,50	0,50	1,00	0,75	0,75	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,08	0,05	0,05	0,55
A6	0,00	0,50	0,50	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,50
A7	0,00	0,75	0,50	1,00	0,75	0,75	1,00	1,00	0,00	0,15	0,10	0,10	0,08	0,08	0,10	0,10	0,70
A8	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A9	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A10	0,00	0,50	0,75	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,05	0,05	0,05	0,05	0,55
A11	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A12	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A13	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A14	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A15	0,00	0,50	0,50	1,00	0,25	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,03	0,05	0,05	0,05	0,48
A16	1,00	0,50	0,50	0,00	0,75	0,50	0,50	0,50	0,10	0,10	0,10	0,00	0,08	0,05	0,05	0,05	0,53
A17	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A18	0,00	0,50	0,50	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,50
A19	0,00	0,50	0,00	1,00	1,00	0,50	0,75	1,00	0,00	0,10	0,00	0,10	0,10	0,05	0,08	0,10	0,53
A20	0,00	0,25	0,50	0,00	0,50	0,50	0,50	0,50	0,00	0,05	0,10	0,00	0,05	0,05	0,05	0,05	0,35

The calculation results obtained in Table 10, Table 11, and Table 12 are the result of multiplying the **factor weight** (FW) in Table 1 with the **factor evaluation** (FE) on each of the sub-criteria in Tables 2 to 9. As For example, the calculation of **Weight Evaluating** (WE) on the DM-1 assessment for alternative A1 can be described as follows:

$$TWE = \sum(FW \times FE)$$

Where TWE (Total Weight Evaluating), FW (Factor Weight), and FE are (Factor Evaluation) as described in formula (1). Thus, the Weight Evaluation for A1 by DM-1 as presented in Table 10 in the first row for each criterion is as follows:

WE (A1-C1) = FW (C1) x E(A1-C1)
= 0,1 x 0,0
= 0,0
WE (A1-C2) = FW (C2) x E(A1-C2)
= 0,2 x 0,75
= 0,15
WE (A1-C3) = FW (C3) x E(A1-C3)
= 0,2 x 0,75
= 0,15
WE (A1-C4) = FW (C4) x E(A1-C4)
= 0,1 x 1,00
= 0,10
WE (A1-C5) = FW (C5) x E(A1-C5)
= 0,1 x 0,75
= 0,075≈0,08
WE (A1-C6) = FW (C6) x E(A1-C6)
= 0,1 x 0,50
= 0,05
WE (A1-C7) = FW (C7) x E(A1-C7)
= 0,1 x 0,50
= 0,05
WE (A1-C8) = FW (C8) x E(A1-C8)
= 0,1 x 0,50
= 0,05

Table 12: Rating Table by DM-3

ID	Factor Evaluation (FE)								Weight Evaluation (WE)								SUM
	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	(WE)
A1	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A2	0,00	0,75	0,75	1,00	0,75	0,75	0,75	0,75	0,00	0,15	0,15	0,10	0,08	0,08	0,08	0,08	0,70
A3	0,00	0,75	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
A4	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53

A5	0,00	0,50	0,50	1,00	0,75	0,75	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,08	0,05	0,05	0,55
A6	0,00	0,50	0,50	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,50
A7	0,00	0,75	0,50	1,00	0,75	1,00	1,00	1,00	0,00	0,15	0,10	0,10	0,08	0,10	0,10	0,10	0,73
A8	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A9	0,00	0,50	0,75	1,00	1,00	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,10	0,05	0,05	0,05	0,60
A10	0,00	0,50	0,75	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,05	0,05	0,05	0,05	0,55
A11	0,00	0,50	0,75	1,00	1,00	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,10	0,05	0,05	0,05	0,60
A12	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A13	0,00	0,50	0,75	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
A14	0,00	0,50	0,50	1,00	0,50	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,50
A15	0,00	0,50	0,50	1,00	0,25	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,03	0,05	0,05	0,05	0,48
A16	1,00	0,50	0,50	0,00	0,75	0,50	0,50	0,50	0,10	0,10	0,10	0,00	0,08	0,05	0,05	0,05	0,53
A17	0,00	0,50	0,50	1,00	0,75	0,50	0,50	0,50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
A18	0,00	0,50	0,50	1,00	0,50	0,75	0,75	0,50	0,00	0,10	0,10	0,10	0,05	0,08	0,08	0,05	0,55
A19	0,00	0,50	0,00	1,00	1,00	0,50	0,75	1,00	0,00	0,10	0,00	0,10	0,10	0,05	0,08	0,10	0,53
A20	0,00	0,25	0,50	0,00	0,50	0,50	0,50	0,50	0,00	0,05	0,10	0,00	0,05	0,05	0,05	0,05	0,35

4.3 Aggregation of Recommended Results

After the ranking process for each decision maker (DM) is completed, the next process is aggregation to get the most optimal value as the final result.

4.3.1 Collecting the ranking results of each decision maker

Table 13 provides information that from each decision maker DM-1, DM-2, DM-3 obtained different rankings. For example, Alternative A1 is rated by DM-1 and is ranked 3, while by DM-2 it is ranked 2, and by DM-3 it is ranked 3. The distribution of alternative rankings by each decision maker is quite diverse.

Table 13: Ranking by Decision Maker.

Alternative	DM-1	DM-2	DM-3
A1	3	2	3
A2	4	3	2
A3	5	4	4
A4	12	11	12
A5	10	9	9
A6	18	17	17
A7	2	1	1
A8	13	12	13
A9	6	5	5
A10	11	10	11
A11	7	6	6
A12	8	7	7
A13	9	8	8
A14	14	13	18
A15	19	19	19
A16	15	14	14
A17	16	15	15
A18	1	18	10
A19	17	16	16
A20	20	20	20

4.3.2 Giving Borda Points

Borda point is done by assigning points as shown in Table 14 where the first rank will be given a weight of 19 and the last rank will be given a weight of 0. This is taking into account that the number of alternatives is 20 data. Borda Point Value.

Table 14: Borda Point Value

Ranking	1	…	20
Point	19	…	0

4.3.3 Counting Borda Count

After determining the borda point, then the Borda Count is calculated to obtain the results as presented in Table 15. For example, the Borda Count obtained from Alternative A1 is 52 which is the sum of 17+18+17 = 52. Borda Count value.

Table 15: Borda Count Value

Alternative	DM1	DM2	DM3	Borda Count
A1	17	18	17	52
A2	16	17	18	51
A3	15	16	16	47
A4	8	9	8	25
A5	10	11	11	32
A6	2	3	3	8
A7	18	19	19	56
A8	7	8	7	22
A9	14	15	15	44
A10	9	10	9	28
11	13	14	14	41
12	12	13	13	38
13	11	12	12	35
14	6	7	2	15
15	1	1	1	3

16	5	6	6	17
17	4	5	5	14
18	19	2	10	31
19	3	4	4	11
20	0	0	0	0

4.3.4 Final Rank

Table 16 presents the information obtained from the final results of the group decision support system recommendation process using MFEP where this is an independent recommendation process carried out by each decision maker. The aggregation process in this case is carried out using Borda to get the final ranking results from each decision maker. Based on the data presented in Table 16, it is shown that Alternative A7 ranks first with the highest Borda point of 56, followed by alternatives A1, A2, A3, and so on which provides information that the lower the alternative ranking, the less recommended the alternative.

Table 16: Final Rank

No.	Alternative	Borda Point	Ranking
1	A7	56	1
2	A1	52	2
3	A2	51	3
4	A3	47	4
5	A9	44	5
6	A11	41	6
7	A12	38	7
8	A13	35	8
9	A5	32	9
10	A18	31	10
11	A10	28	11
12	A4	25	12
13	A8	22	13
14	A16	17	14
15	A14	15	15
16	A17	14	16
17	A19	11	17
18	A6	8	18
19	A15	3	19
20	A20	0	20

4.4 Software Implementation

From the model that has been formulated in the previous discussion, this research is also implemented using a computer-based information system that will be used directly by decision makers in the Group Decision Support System (GDSS).

Figure 3 presents an overview of a number of factors and their weights that are considered as criteria in providing recommendations in the GDSS. The total number of all these factors or criteria must be equal to 1, according to the concept in the Multifactor Evaluation Process (MFEP) method.

Figure 4 shows the results of recommendations from decision makers involved in the GDSS. The data used are 8 criteria for alternatives as many as 20 data items. Each decision maker will give his preference in this application page.

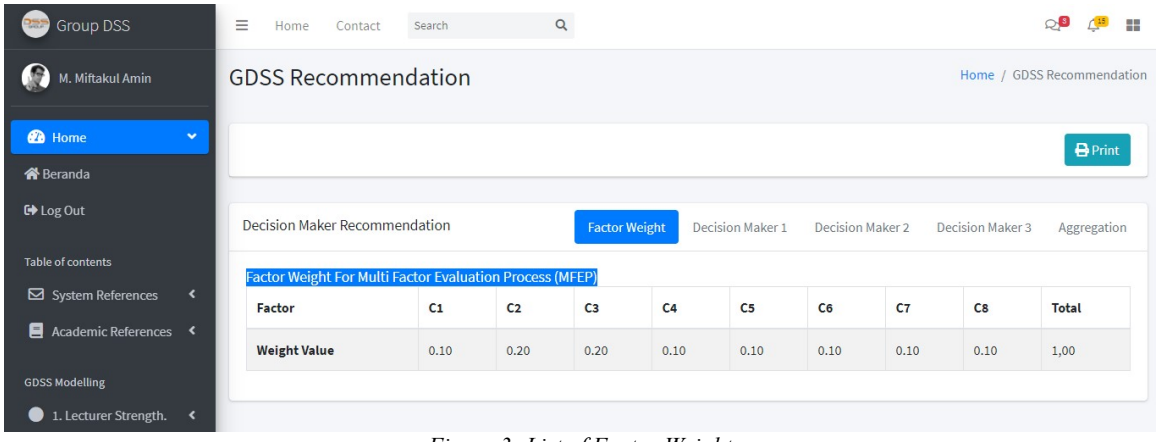

Figure 3: List of Factor Weight

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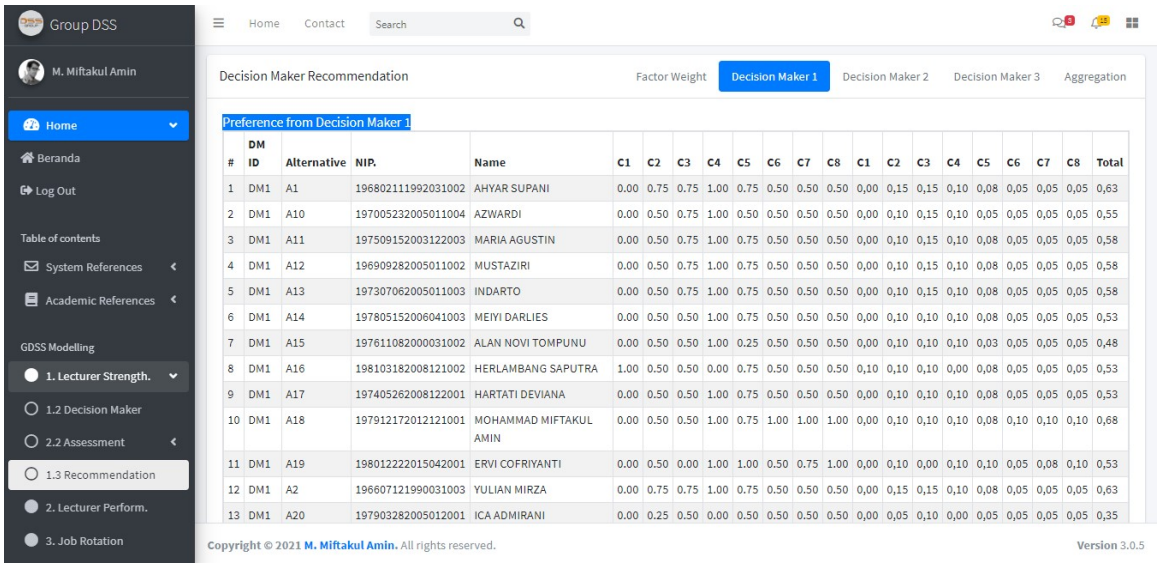
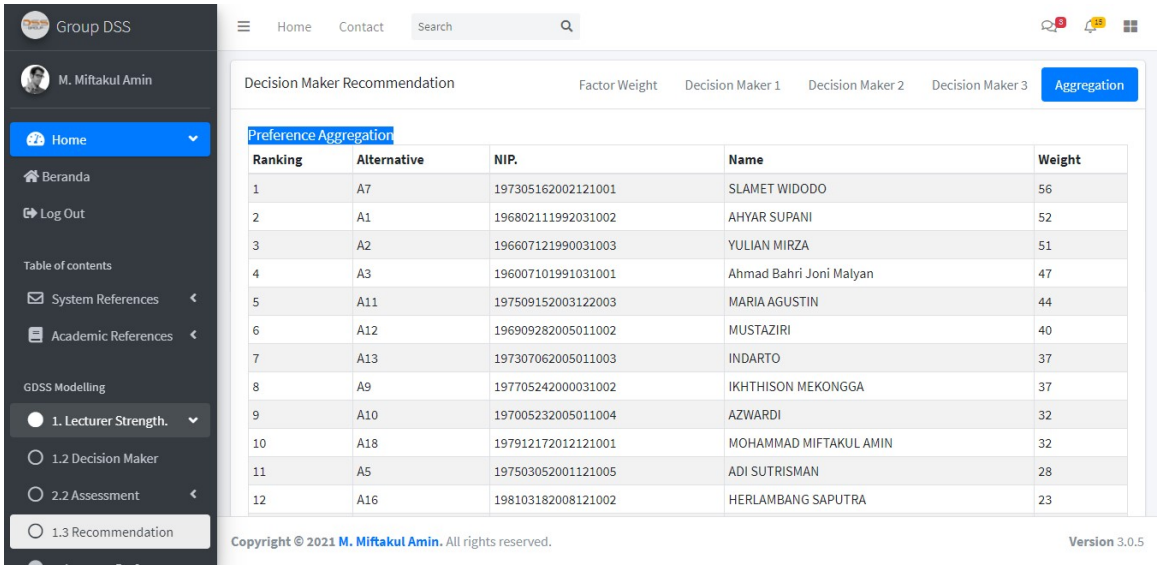


#	DM ID	Alternative	NIP.	Name	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	Total
1	DM1	A1	196802111992031002	AHYAR SUPANI	0.00	0.75	0.75	1.00	0.75	0.50	0.50	0.50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
2	DM1	A10	197005232005011004	AZWARDI	0.00	0.50	0.75	1.00	0.50	0.50	0.50	0.50	0,00	0,10	0,15	0,10	0,05	0,05	0,05	0,05	0,55
3	DM1	A11	197509152003122003	MARIA AGUSTIN	0.00	0.50	0.75	1.00	0.75	0.50	0.50	0.50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
4	DM1	A12	196909282005011002	MUSTAZIRI	0.00	0.50	0.75	1.00	0.75	0.50	0.50	0.50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
5	DM1	A13	197307062005011003	INDARTO	0.00	0.50	0.75	1.00	0.75	0.50	0.50	0.50	0,00	0,10	0,15	0,10	0,08	0,05	0,05	0,05	0,58
6	DM1	A14	197805152006041003	MEIYI DARLIES	0.00	0.50	0.50	1.00	0.75	0.50	0.50	0.50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
7	DM1	A15	197611082000031002	ALAN NOVI TOMPUNU	0.00	0.50	0.50	1.00	0.25	0.50	0.50	0.50	0,00	0,10	0,10	0,10	0,03	0,05	0,05	0,05	0,48
8	DM1	A16	198103182008121002	HERLAMBANG SAPUTRA	1.00	0.50	0.50	0.00	0.75	0.50	0.50	0.50	0,10	0,10	0,10	0,00	0,08	0,05	0,05	0,05	0,53
9	DM1	A17	197405262008122001	HARTATI DEVIANA	0.00	0.50	0.50	1.00	0.75	0.50	0.50	0.50	0,00	0,10	0,10	0,10	0,08	0,05	0,05	0,05	0,53
10	DM1	A18	197912172012121001	MOHAMMAD MIFTAKUL AMIN	0.00	0.50	0.50	1.00	0.75	1.00	1.00	1.00	0,00	0,10	0,10	0,10	0,08	0,10	0,10	0,10	0,68
11	DM1	A19	198012222015042001	ERVI COFRIYANTI	0.00	0.50	0.00	1.00	1.00	0.50	0.75	1.00	0,00	0,10	0,00	0,10	0,10	0,05	0,08	0,10	0,53
12	DM1	A2	196607121990031003	YULIAN MIRZA	0.00	0.75	0.75	1.00	0.75	0.50	0.50	0.50	0,00	0,15	0,15	0,10	0,08	0,05	0,05	0,05	0,63
13	DM1	A20	197903282005012001	ICA ADMIRANI	0.00	0.25	0.50	0.00	0.50	0.50	0.50	0.50	0,00	0,05	0,10	0,00	0,05	0,05	0,05	0,05	0,35

Figure 4: Preference form Decision Maker 1



Ranking	Alternative	NIP.	Name	Weight
1	A7	197305162002121001	SLAMET WIDODO	56
2	A1	196802111992031002	AHYAR SUPANI	52
3	A2	196607121990031003	YULIAN MIRZA	51
4	A3	196007101991031001	Ahmad Bahri Joni Malyan	47
5	A11	197509152003122003	MARIA AGUSTIN	44
6	A12	196909282005011002	MUSTAZIRI	40
7	A13	197307062005011003	INDARTO	37
8	A9	197705242000031002	IKHTHISON MEKONGGA	37
9	A10	197005232005011004	AZWARDI	32
10	A18	197912172012121001	MOHAMMAD MIFTAKUL AMIN	32
11	A5	197503052001121005	ADI SUTRISMAN	28
12	A16	198103182008121002	HERLAMBANG SAPUTRA	23

Figure 5: Ranking of GDSS Recommendation

Figure 5 shows the final result of the ranking process obtained from the aggregation of decision makers who have given their preferences independently. The results shown in Figure 5 are also the final results of the GDSS process generated by the system. From Figure 5, it can be seen that alternative A7 gets a borda score of 56, followed by A1 of 52, A2 of 51, and so on. The greater the borda score, the more the alternative will be recommended by the GDSS system.

Based on the results recommended by the GDSS, obtained the same recommendation results as the formulation described in the previous section.

The selection of the 8 criteria was based on various considerations that had been gathered from the management at the university. This is based on the criteria chosen in every activity in the university environment which always includes various criteria that have been selected. Several similar studies, such as that conducted by [14], looked at the aspect of test results before determining the chosen alternative. This study argues that the selection of lecturers strengthening does not look at the assessment aspect of the exam results, but is an accumulation of performance and achievements over a long period of time during a career in college.

5. CONCLUSION

Referring to the results of the analysis of the group decision support system model using a combination of MFEP and BORDA algorithms, several conclusions are obtained as follows:

1. By the construction of a group decision support system through the use of the MFEP and BORDA methods to determine prospective lecturers who will participate in lecturer strengthening activities, it helps the selection process carried out within the Department of Sriwijaya State Polytechnic.
2. Aggregation of each different decision maker can be done using the Borda method so that the final ranking results are obtained.

This research can be developed using other methods as an alternative comparison to get a better decision support system model. One of the disadvantages of this BORDA method is that the final values are the same, but sorted in alphabetical order by alternative names. It is necessary to take another approach based on more in-depth weighting, so that if there are the same final scores, the ranking order is based on a more specific weighted value.

REFRENCES:

[1] Thi Ngoc Trang Tran, Muslum Atas, Alexander Felfernig, Ralph Samer, Martin Stettinger, "Investigating Serial Position Effects in Sequential Group Decision Making", *UMAP '18:26 th Conference on User Modeling, Adaptation and Personalization*, July 8-11, 2018, Singapore, pp. 239-243.

[2] Siti Fatimah, Ahmad Laongko, Muzakir Tombolotutu, "Borda Application of Selection Planning Scheduling Method in Dock Engineering Consultants in Central Sulawesi Province Indonesia", *First International Conference on Economics and Banking (ICEB-15)*, 2005, pp. 361-364.

[3] Jon Fraenkel, Bernard Grofman, "The Borda Count and Its Real-World Alternatives: Comparing Scoring Rules in Nauru and Slovenia", *Australian Journal of Political Science*, vol. 49, no. 2, 2014, pp. 186-205.

[4] Lihi Naamani-Dery, Inon Golan, Meir Kalech, Lior Rokach, "Preference Elicitation for Group Decision using the Borda Voting Rule", *Group Decision and Negotiation*, vol. 24, 2015. pp. 1015-1033.

[5] Widyastuti Andriyani, Sri Hartati, Retyanto Wardoyo, Samekto Wibowo, "A Development of Modified Profile Matching and Borda for Determining Treatment Priorities for Hemorrhage Stroke Patients", *International Journal of Scientific & Engineering Research*, vol. 10, no. 2, 2019. pp. 611-619

[6] Wiwi Verina, Muhammad Fauzi, Fina Nasari, Dahriani Hakim Tanjung, Juli Iriani, "Decision Support System for Employee Recruitment using Multifactor Evaluation Process", *The 6th Conference on Cyber and IT Service Management (CITSM 2018)*, Medan, August 7-9, 2018

[7] Teuku Mufizar, Evi Dewi Sri Mulyani, Restu Adi Wiyono, Wendi Arifiana, "A Combination of Multi Factor Evaluation Process (MFEP) and The Distance to The Ideal Alternative (DIA) Methods for Majors Selection and Scholarship Recipients in SMAN 2 Tasikmalaya", *The 6th Conference on Cyber and IT Service Management (CITSM 2018)*, Medan, August 7-9, 2018

[8] Luis Conceico, Diogo Martinho, Rui Andrade, Joao Carneiro, Constantino Martins, Goreti Marreiros, Paulo Novais, A Web-Based Group Decision Support System for Multicriteria Problems, *Concurrency and Computation Practice and Experience*, pp. 1-12, 2019

[9] Marcella Maia Urtiga, Danielle Costa Morais, Keith W. Hipel, D. Marc Kilgour, *Group Decision Methodology to Support Watershed Committees in Choosing Among Combinations of Alternatives*, Group Decis Negot, vol. 26, pp. 729-752, 2017

[10] Wan Rosanisah Wan Mohd and Lazim Abdullah, "Aggregation Methods in Group Decision Making: A Decade Survey", Informatica, vol. 14, 2017, pp. 71-86

[11] Yulmaini, Anuar Sanusi, M. Arieza Eka Yusendra, "The Implementation of AHP for Determining Dominant Criteria in Higher Education Competitiveness Development Strategy Based on Information Technology", International Journal of Artificial Intelligence Research, vol. 3, no. 1, June 2019, pp. 25-23.

[12] Ermatita, Sri Hartati, Retantyo Wardoyo, Agus Harjoko, "Development of Copeland Score Methods for Determine Group Decisions", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 4, no. 6, 2013, pp. 240-242

[13] A. Dennis, J. George, L. Jessup, MIS Quarterly, vol. 12, no. 4, 1988, pp. 591-624

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[14] Wiwien Hadikurniawati, Retantyo Wardoyo, "A Multi-Attribute Decision Making for Eletrician Selection using Triangular Fuzzy Numbers Arithmetic Approach", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 6, no. 9, 2015, pp. 173-178

[15] Herri Setiawan, Retantyo Wardoyo, "The Group Decision Support System to Evaluate the ICT Project Performance using the Hybrid Method of AHP, TOPSIS, and Copeland Score", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 7, no. 4, 2016, pp. 334-341

[16] Ibrahim M. Al-Jabri, Mustafa I. Eid, M. Sadiq Sohail, "A Group Decision-Making Method for Selecting Cloud Computing Service Model", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 9, no. 1, 2018, pp. 449-456

[17] Heru Ismanto, Suharto, Azhari, Lincolin Arsyad, "Ranking Method in Group Decision Support to Determine the Regional Prioritized Areas and Leading Sectors using Garret Score", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 9, no. 11, 2018, pp. 94-99

[18] Kusrini, Kusuma Chandra Kirana, Muhammad Idris Purwanto, Arif Dwi Laksito, "GIS-Based Decision Support System for Cash Waqf Distribution", Journal of Theoretical and Applied Information Technology, vol. 96, no. 3, 2018, pp. 701-711

[19] Rosmayati Mohemad, Siti Zulaikha Kamaruddin, Noor Maizura Mohamad Noor, "Web-Based Decision Support System for Dietary Meal Plan Recommendation", Journal of Theoretical and Applied Information Technology, vol. 96, no. 23, 2018, pp. 7864-7875

[20] Saly Eid Helmy, Gamal H. Eladl, Mohamed Eisa, "Fuzzy Analytical Hierarchy Process (FAHP) using Geometric Mean Method to Select Best Processing Framework Adequate to Big Data", Journal of Theoretical and Applied Information Technology, vol. 99, no. 1, 2021, pp. 207-226

[21] Turban, E., et.al, "Decision Support System and Intelligent Systems", 2005, Prentice Hall International Inc.