Journal of Information Systems and Informatics
Vol. 4, No. 4, December 2022 e-ISSN: **2656-4882** p-ISSN: **2656-5935**
http://journal-isi.org/index.php/isi Published By DRPM-UBD

Local Government Project Assessment Application Using Group Decision Support System (GDSS) Model

Herri Setiawan[1], Dhamayanti[2], Tasmi[3]

[1, 2, 3] Faculty of Computer Science, Universitas Indo Global Mandiri, Palembang, Indonesia
[1]herri@uigm.ac.id, [2]dhamayanti@uigm.ac.id, [3]tasmi@uigm.ac.id

Abstract

The assessment process is an important step in the evaluation, as it underlies the successful evaluation of a project. One solution to make the project assessment more objective is to apply the concept of a Group Decision Support System (GDSS), which in the decision process uses computing. This research tries to implement the concept by building an application for project evaluation and providing recommendations on project performance in local government agencies. The proposed Decision Makers (DMs) are involved: Executives of Government Institutions, Project Management Work Units, Business Process Owner Units, and Communities represented by the DPRD. The computational process uses the Multi-Criteria Decision Making (MCDM) method, and the Copeland scores voting method ranks the project of all DMs. The results of application computing in implementing GDSS and MCDM indicate that the process of determining project rankings will be faster and more accurate.

Keywords: project, GDSS, MCDM, local government

1. INTRODUCTION

Activities (projects) in government agencies are part of the program and consist of a set of measures for deploying resources, whether in the form of personnel (HR), capital goods including equipment and technology, funds, or hybrids of some or all types of these resources as inputs to produce outputs in the form of goods/services. Measuring project performance in government agencies, including current projects, has a weakness because it does not reflect the project evaluation that is generally carried out, which is only based on the percentage of achievement of the planned level of achievement (target) of each activity (project) performance indicator as determined through the realization achieved in the indicator in question [1].

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

The calculation of the percentage of achievement of the activity achievement level plan used is based on the absorbed funds and the realization of output between the realization compared to the plan, which is contained in the administrative document of the Government Agency Performance Accountability Report (LAKIP). There can be no correlation between the output and the expected outcome. In the current LAKIP measurement method, including the evaluation of activities (projects), the criteria used to measure the performance of new organizations are limited to quantitative criteria, namely the timeliness of implementation and effectiveness in using financial resources.

Based on the problems mentioned, an institutional decision-making system must be an activity that individuals, groups, and organizations can carry out. One widely offered solution for making decisions using computing is the Group Decision Support System (GDSS). The model was created with various approaches, one of which used an approach to the GDSS [2]. This model is formulated concerning social choice theory. The model is structured using a voting mechanism in such a way as to allow each decision-maker to express their choice. Research shows that this model can accommodate Multi-Criteria Decision Making (MCDM). In modeling, the choice (vote) of the DM is considered. MCDM is an instrument for many individuals to select candidates or alternatives. From this meaning, decision-making multi-criteria (MCDM) is used to establish the best alternative of several alternatives based on specific criteria [3].

There have been many previous studies using this method, such as [4]; [5]); [6]); [7]; [8]); [9]. One popular method used for it is the Analytic Hierarchy Process (AHP). This method uses human perception input and can process qualitative data, resulting in a comprehensive decision-making model. This is because AHP can solve multi-objective and multi-criteria problems based on a comparison of the preferences of each element in the hierarchy. However, the AHP method has a disadvantage because the main input is perception, so it involves subjectivity; this will be a problem if the DM gives a wrong judgment. Another popular method used in the project's scope is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). This method is used because it is closely related to the benefits and costs of a project. This method is based on the concept that the best-selected alternative has the shortest distance from the positive ideal solution (benefit) and the longest distance from the negative ideal solution (cost). The main drawback of the TOPSIS method is that it does not provide weight elimination and assessment consistency checks [10].

This research will create a Group Decision Support System (GDSS) model for project evaluation, which meets administrative or normative needs and a more objective evaluation to facilitate the achievement of consensus between DMs while respecting different preferences, interests, and values. GDSS is expected to

p-ISSN: 2656-5935 http://journal-isi.org/index.php/isi e-ISSN: 2656-4882

expand DM capabilities but not to replace DM assessments. What is to be realized is "a new decision model implemented in a computer-based system that supports a group of people who belong to the same task or goal and have one particular means that serves to connect the people in the group." This has been known as the Group Decision Support System (GDSS) [11].

2. METHODS

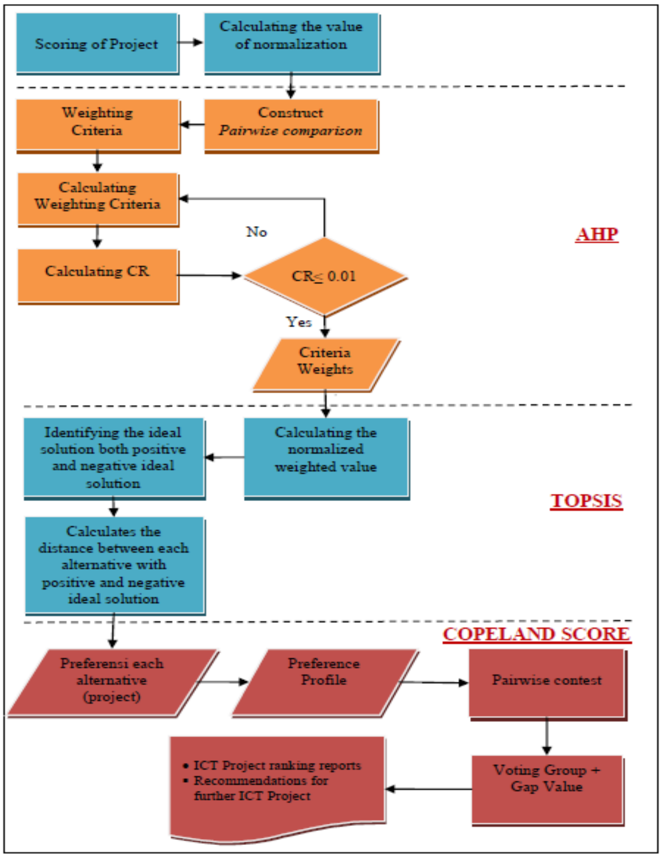


Figure 1. Flow combination of methods used

This research builds an application as an implementation of the GDSS model for project evaluation in local government agencies in determining the best project ranking, using the MCDM hybrid method, using program/activity data in the districts/cities of South Sumatra Province. The MCDM combination method is developed based on the Analytical Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Copeland Score methods, each of which has its role [12]. To determine the weight of the criteria,

p-ISSN: 2656-5935 http://journal-isi.org/index.php/isi e-ISSN: 2656-4882

the weighting technique contained in the AHP method is used, then the results of weighting the criteria will be input in the TOPSIS calculation, which is used to determine the ranking as a result of evaluating the performance of the activity. From the calculation of TOPSIS, the ranking of each DM project is generated, and to unify the differences in preferences between DMs, the Copeland Score method is used as one of the voting methods to determine the best project ranking from all decision-makers.

The Copeland Score method developed is carried out by adding the gap (distance) of victory between the alternatives during the pairwise contest and then the existing gap multiplied by the weight or population of DM to overcome the voting process that draws (tie). Figure 1 is a flow of combinations of methods used.

2.1 Algorithms Calculating Weighting

In this section, we perform a combination of AHP and TOPSIS methods with the preparation of a pairwise comparison matrix and perform criteria weighting, with the ultimate goal being to determine whether matrix A is consistent or not, as intended in Algorithm 1.

a) Each Decision Maker (DMi) has its assessment criteria (C_{ij}).
b) In process 2, matrix A is squared, and in process 3, matrix B is calculated, matrix B. Matrix B is the summation of elements in the same row as matrix A. Based on Matrix B, the eigenvector is calculated, so that matrix E is obtained and deciphered in process 4.
c) Process 5,6,7,8 is to calculate the consistency of the index by deriving a matrix C, which is the multiplication between matrix A and matrix E. Based on matrix C, it is determined whether matrix A is consistent. If it is consistent, then the weight of matrix A is calculated by calling the Algorithm Calculating the Weighted Normalization Value.
d) The output of this Algorithm is the Criterion Weight (Wk) of each DM.

Algorithm 1 Calculating Weighting Criteria [13]

```
Input:
    DMi = {DM i | i = 1,2,3,..., n} ;
    Cij = {Cij | j= 1,2,3..} ;
Output: Wk;
Process:
Begin
1. A[i,j] ;
2. A²[i,j] = A[i,j] * A[i,j];
3. for k = 1 to i
        B(k,1) = Σ_{i=1}^{i=j} A2(k, l);
```

p-ISSN: 2656-5935 http://journal-isi.org/index.php/isi e-ISSN: 2656-4882

```
        End
  4. for  k = 1 to i
        E(k,1) = B (K,1)/∑ B(:,1)
        End
  5. C [k,1] = A[i,j] *E[k,1] ;
```

6. λ max = 1/k * $(\sum_{k=1}^{k=i} \frac{E[k,:]}{C[K,:]})$

7 C1 = $\frac{\partial - k}{k-1}$

```
  8. if C1 < 10%
        W = Bobot (A)
     Else
       Evaluate the pairwise comparison value on A[i,j]
       Enda
  End
```

2.2 Calculating Normalization Value

This Algorithm describes the normalized value of all alternatives for each criterion and calculates the normalized value of its weight as shown by Algorithm 2.

a) Decision Maker scores all ICT alternatives (projects) based on the assessment criteria they have so that after being converted based on the assessment rating, the results are obtained in the form of a Scoring Matrix (SC)

b) Process 2 calculates the normalized value of all alternatives for each criterion (Matrix X), and process 3 calculates the weighted normalized value (Matrix Y)

Algorithm 2 Calculating Normalization Value [13], [14]

```
Input: Matrics Scoring (SC)
          W = Matrix weights masing masing kriteria
Output: Normalized Scoring Matrix (R)
          Normalized Scoring Matrix Weights (Y)
Process:
Begin
1.  i = size (SC,1); j=size (SC,2) // i,j is the dimension of the
    DM scoring matrix, i state the row representation of the
    alternate number (project), and j is the column states the
    number of criteria
2.  for k = 1 to i
       for l = 1to j
           R (k,l) =  SC (k,l)/(∑ SC(k, l; ))
       End
    End
3.  for k = 1 to i
       for l = 1to j
```

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

```
            Y [k,l]=   R [k,l] * E[1,l]
          End
        End
    End
```

3 RESULTS AND DISCUSSION

Assessment and evaluation of the implementation of ICT projects in local government agencies, involving 4 (four) Decision Makers (DM), namely the Business Process Owner Unit (DM1), ICT Management Work Unit (DM2), Government Institution Executive (DM3) and the Community represented by the DPRD (DM4). The assessment parameters used consist of 7 (seven) criteria, namely Project Schedule (C1), Project Cost (C2), Project Scope (C3), Project Risk (C4), Project Performance (C5), Project Effectiveness (C6), and Project User Satisfaction (C7). In conducting the assessment, DM1 will evaluate each alternative (project) based on 3 (three) criteria C={C1, C2, C3}, DM2 will evaluate each alternative based on 2 (two) criteria C={C4, C5}, DM3 and DM4 evaluate each alternative based on 2 (two) criteria C={C6, C7}.

The application is built to assess a project in the local government. This system is designed with several stages of implementation to produce good results in making a decision, and this activity starts with the user logging into the application, as shown in figure 2.

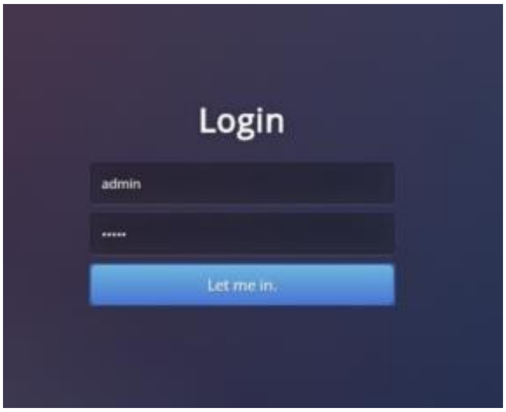


Figure 2. Login Page

Figure 3 shows the application's main view consisting of the settings menu, process, voting, setup, and session. Administrators can only use the setup and session menus.

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

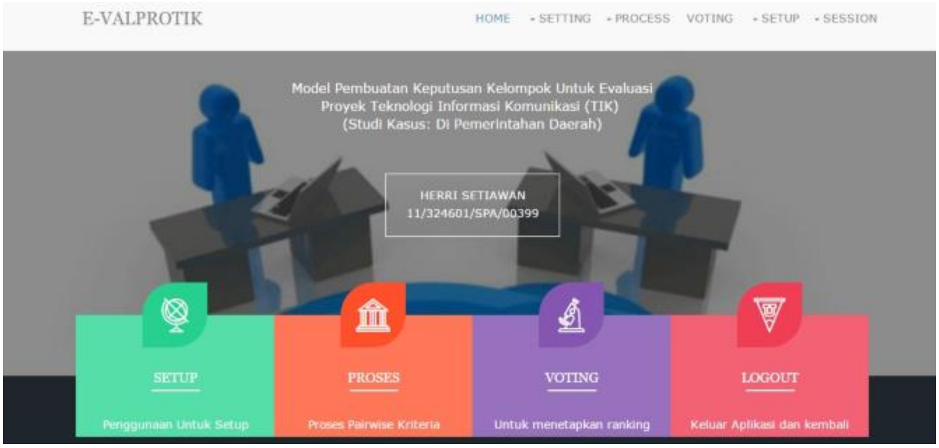


Figure 3. Main Page

The setting menu has a sub-menu of activities, criteria, SKPD, Region, and DM. The criteria sub-menu that can be seen in Figure 4 contains a list of activities (projects) to be evaluated.

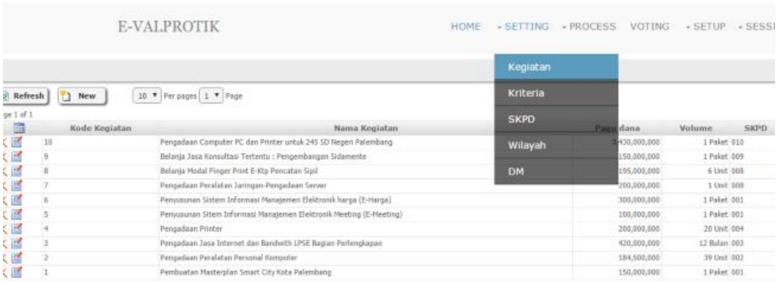


Figure 4. Activity Settings

The assessment of each DM uses predetermined criteria, as shown in figure 5. The criteria used are different for each DM.

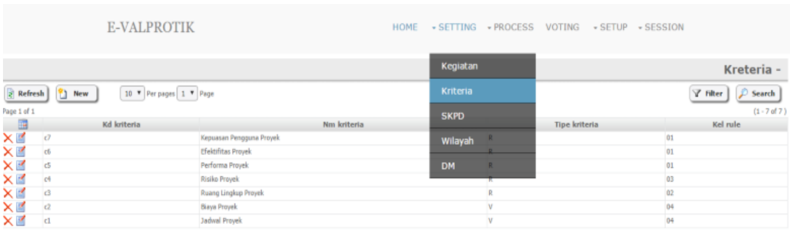


Figure 5. Setting Criteria

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

SKPD/OPD is the Unit/Service implementing activities/projects. Figure 5 is a sub-menu for SKPD input.

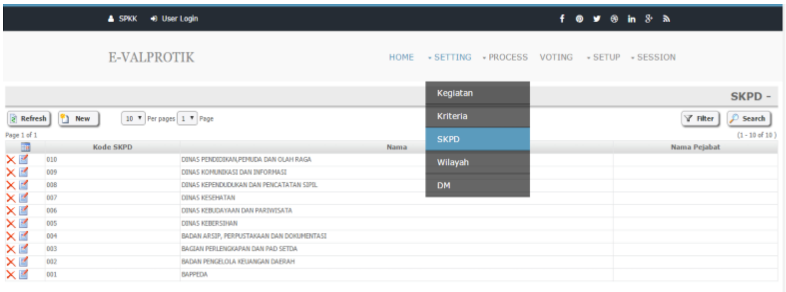


Figure 6. SKPD Settings

In the regional input menu, as shown in Figure 7 is the input for the district/city that will use the assessment application

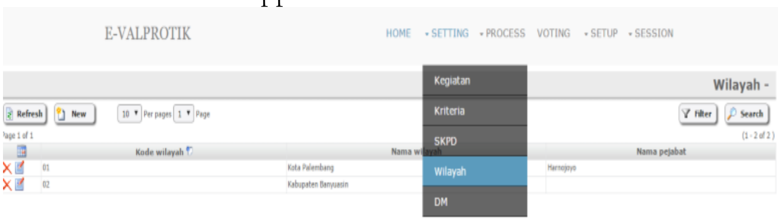


Figure 7. Region Configuration

Then the last sub-menu on the settings menu is for DM inputs involved in the assessment. The image of the DM sub-menu can be seen in Figure 8.

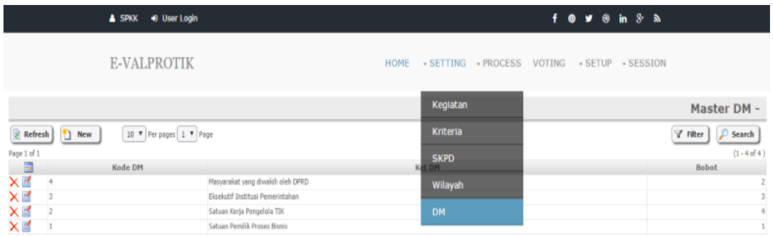
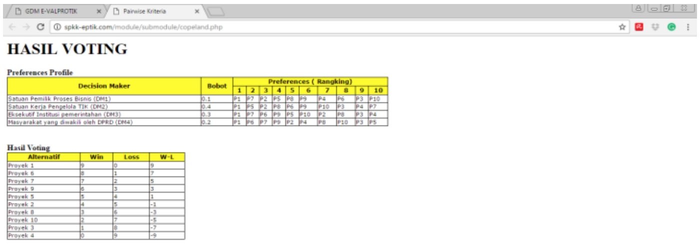


Figure 8. DM settings

The results of the process and voting of all DM assessments in the form of project rankings that have been evaluated are shown in Figure 9.

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**



HASIL VOTING

Preferences Profile

Decision Maker	Bobot	Preferences (Rangking)									
		1	2	3	4	5	6	7	8	9	10
Satuan Pemilik Proses Bisnis (DM1)	0.1	P1	P7	P2	P5	P8	P9	P4	P6	P3	P10
Satuan Kerja Pengelola TIK (DM2)	0.4	P1	P5	P2	P8	P6	P9	P10	P3	P4	P7
Eksekutif Institusi pemerintahan (DM3)	0.3	P1	P7	P6	P9	P5	P10	P2	P8	P3	P4
Masyarakat yang diwakili oleh DPRD (DM4)	0.2	P1	P6	P7	P9	P2	P4	P8	P10	P3	P5

Hasil Voting

Alternatif	Win	Loss	W-L
Proyek 1	9	0	9
Proyek 6	8	1	7
Proyek 7	7	2	5
Proyek 9	6	3	3
Proyek 5	5	4	1
Proyek 2	4	5	-1
Proyek 8	3	6	-3
Proyek 10	2	7	-5
Proyek 3	1	8	-7
Proyek 4	0	9	-9

Figure 9. Voting Results

4 CONCLUSION

This research produced an activity evaluation application in local government agencies in Indonesia using the Group Decision Support System (GDSS) concept or Group Decision Support System (SPKK). The DM involves 1). Executive government institutions, 2). ICT Management Work Unit, and 3). Business Process Owner Unit and the community represented by DPRD. The assessment results of each DM produce a ranking of project performance from the best to the lowest and become one of the considerations for activities (projects) in the following fiscal year, thereby providing solutions for improvements to the ICT project evaluation mechanism in local governments. Improvements were made by accommodating a variety of relevant decision-makers with more objective assessment criteria resulting in more measurable and accountable assessments.

REFERENCES

[1] Lembaga Administrasi Negara Republik Indonesia, "Pedoman Penyusunan Pelaporan Akuntabilias Kinerja Instansi Pemerintah," 2003.
[2] C. L. Hwang and M.-J. Lin, Group Decision Making under Multiple Criteria: Method and Applications, vol. 281, no. 0. Springer-Verlag, 1987.
[3] D. Turban, E; Sharda, R; Delen, Decision Support Systems and Intelligent Systems. Boston: Prentice Hall, 2011.
[4] T. Bakshi, A. Sinharay, and B. Sarkar, "Exploratory Analysis of Project Selection through MCDM," in ICOQM-10, 2011, pp. 128–133.
[5] S. M. Kazemi, S. M. M. Kazemi, and M. Bahri, "Six Sigma project selections by using a Multi Criteria Decision making approach: a Case study in Poly Acryl Corp.," in Proceedings of the 41st International Conference on

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

Computers & Industrial Engineering, 2011, pp. 502–507.
[6] H. Ismaili, "Multi-Criteria Decision Support for Strategic Program Prioritization at Defence Research and Development Canada," University of Ottawa, 2013.
[7] E. W. N. Bernroider, N. Obwegeser, and V. Stix, "Dissemination and impact of multi-criteria decision support methods for IT project evaluation," Proc. Annu. Hawaii Int. Conf. Syst. Sci., pp. 1103–1112, 2014.
[8] J. Żak and M. Kruszyński, "Application of AHP and ELECTRE III/IV Methods to Multiple Level, Multiple Criteria Evaluation of Urban Transportation Projects," Transp. Res. Procedia, vol. 10, no. July, pp. 820–830, 2015.
[9] A. Rabbani, M. Zamani, A. Yazdani-Chamzini, and E. K. Zavadskas, "Proposing a new integrated model based on sustainability balanced scorecard (SBSC) and MCDM approaches by using linguistic variables for the performance evaluation of oil producing companies," Expert Syst. Appl., vol. 41, no. 16, pp. 7316–7327, 2014.
[10] H. S. Shih, H. J. Shyur, and E. S. Lee, "An extension of TOPSIS for group decision making," Math. Comput. Model., vol. 45, no. 7–8, pp. 801–813, 2007.
[11] R. McLeod and G. P. Schell, Management Information System, 10rd ed. New Jersey: Pearson Prentice Hall, 2007.
[12] H. Setiawan, J. Eko, R. Wardoyo, and P. Santoso, "The Group Decision Support System to Evaluate the ICT Project Performance Using the Hybrid Method of AHP, TOPSIS and Copeland Score," Int. J. Adv. Comput. Sci. Appl., vol. 7, no. 4, pp. 334–341, 2016.
[13] Saaty, T. L., "How to make a decision: The Analytic Hierarchy Process. European journal of operational research, 48 (1990) 9-26 North-Holland, 1990
[14] Cheng, S.K., "Development of a Fuzzy Multi-Criteria Decision Support System for Municipal Solid Waste Management", A Thesis. University of Regina, 2000.