Study of the Impact of Decision-Making on the Procurement of Goods and Services for the Rehabilitation of State Buildings in the West Nusa Tenggara Province Utilizing the Simple Additive Weighting (SAW) Method

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Abstract. Maintenance of state buildings can be carried out through providers or through self-management and contractual methods. The choice of implementation is regulated in regulations regarding government procurement of goods and services. Procurement of goods and services is an important management function, both in the public sector (government) and in the private sector. In the government sector, the procurement function becomes more important due to the increasing public demand for services resulting from the government procurement process, as well as the increasing government budget spent through the procurement process. Both types of implementations will certainly have their respective advantages and disadvantages. In this study, the factors that influence the provider (contractual) and self-management systems implemented in the rehabilitation project of state buildings, and the influence of both procurement systems, are determined using Simple Additive Weighting (SAW) as the assessment method to obtain data. Two questionnaires were distributed. The first questionnaire was used to capture factors related to the contractual and self-managed systems. These factors were then categorized into benefit and cost criteria. These criteria served as the basis for the second phase of the questionnaire, which compared the level of preference for each criterion. The questionnaire results were then processed using the SAW method to identify the most influential factors in the implementation of maintenance under the contractual and self-managed systems. Based on the first stage questionnaire, the influencing factors were quality of work, quantity of work, time of work implementation, reasonableness of price, qualification of service provider, experience of service provider, value of work, methodology of work implementation, work administration, and accountability of work. Then the more efficient implementation system based on the SAW method is the contractual system with a weight of 0.98.

Introduction

Maintenance is the activity of repairing and/or replacing parts of a building, components, building materials, and/or infrastructure and facilities so that the building remains functional. This work consists of rehabilitation, renovation, and restoration. Building rehabilitation is carried out in order to repair a partially damaged building with the intention of using it according to a certain function that remains, and both the architecture and structure of the building are maintained as before, while the utilities may change.

Maintenance of state-owned buildings, whether through providers or self-management, must guarantee appropriate quality, effective timeframes, and efficient costs. Therefore, it is deemed necessary to research to determine the extent to which procurement of goods/services through providers (contractual) and self-management in the rehabilitation of state-owned buildings affects quality, timeframes, and costs, and to determine which is better and more profitable of the two system.

In this study, the factors influencing the provision (contractual) and self-management systems implemented in state building rehabilitation projects and the influence of the two provision systems were determined using Simple Additive Weighting (SAW) as the assessment method. The SAW method, also known as a weighted addition method, is one of the simplest and most widely used decision-making methods. This method is the basis of most MADM methods, such as the PROMETHEE and AHP methods. This method uses the concept of additive property for determining the ranks of the alternatives [1][2][3][4]. The SAW for modeling the best DSS selection can produce rational and optimal decision-making [5].

State Buildings are buildings that regulate official needs that will become state assets and are built with funding sources from the State Budget (APBN) and other legitimate sources, including office buildings, school buildings, hospital buildings, warehouses, state houses, and others. State Buildings with their supporting services and facilities. Therefore, in planning state buildings, careful planning is needed in terms of security, cost, use, form, architecture, structure, and available services.

Procurement of goods and services is generally part of the budget expenditure process. When the government conducts a procurement (PBJ), it indirectly involves external parties who can provide the goods and services. This activity creates an agreement with that party, where the provider is a private party. Procurement of goods and services creates a legal relationship between the government, involving the users of the goods and services, and the private party, which acts as the facilitator of those goods and services.

Procurement of goods and services normally has several unfavorable consequences, such as a non-transparent tender process, unhealthy competition between service providers, additional technical descriptions that can only be offered by one particular company, relations whose administration is incomplete but can be involved in the bidding or can even succeed in getting the bid..

The procurement process for goods and services is a crucial aspect of an organization's operational activities. Efficient, transparent, and well-managed procurement is key to an organization's success in achieving its goals. Facing the dynamics of the business environment and advances in information technology, organizations are required to continuously innovate and utilize technology as a tool to improve the efficiency of the procurement process. Government procurement methods for goods and services include self-management and procurement through suppliers. The methods for selecting suppliers of goods, construction work, and other services include e-purchasing, direct procurement, and direct appointment.

Simple Additive Weighting (SAW) is a multi-attribute procedure based on the concept of a weighted summation. The system will look for a weighted summation of the rating of the performance of each alternative on all alternative criteria. The highest score will be the best alternative, and it will be recommended [4].

The simple additive weighting method recognizes two attribute criteria, namely the benefit criteria and the cost criteria. The fundamental difference between these two criteria is in the selection of criteria when making decisions. The simple additive weighting method has the advantage of being able to make more accurate assessments because it is based on the criteria values and predetermined preference weights, and can choose the best alternative from several existing alternatives. In addition, there is an improvement process after determining the weight value for each attribute [6][7][8][9].

SAW can be used for many kinds of determination in any kind of field. SAW can be used to determine the recruitment of contract employees (SPG) to permanent employees using a Decision Support System (DSS) application [10]. SAW can assist the work of the top employee selection team through a multi-criteria weighting process and a fast and accurate selection process [11]. Selecting the best employees at PT Tirta Mumbul Jaya Abadi Singaraja produced accurate and fast data. The SAW method was used in the calculation process to provide the best recommendations [12].

The Simple Additive Weighting (SAW) is used to identify the dominant waste factors in building construction projects in Malang City. Based on calculations, the results showed that the most dominant waste factor in construction projects in Malang City was the waiting criterion with a value of 0.278. Furthermore, the results of this identification will be used to determine the appropriate strategy towards zero waste [13].

Method

Simple Additive Weighting (SAW). Multiple Attribute Decision Making (MADM) is a method used to find the optimal alternative from a number of alternatives with certain criteria [9]. The SAW model is also known as the Weighted Sum Model (WSM) or Scoring Method (SM) and is most often used in MADM techniques. Conceptually, the normalized value of the criteria for an alternative must be multiplied by the criteria weight. Then the best alternative with the highest score is selected as the preferred alternative [10].

The SAW method is a weighted summation method. The basic concept of the SAW method is to find the weighted summation of the performance ratings for each alternative across all attributes. The SAW method requires a normalization process for the decision matrix (X) to a scale that can be compared with all existing alternative ratings [9].

$$R_{ij} = \begin{cases} \dfrac{x_{ij}}{\underset{i}{Max}\, x_{ij}} & \text{If j is a benefit attribute} \\ \dfrac{\underset{i}{Min}\, x_{ij}}{x_{ij}} & \text{If j is a cost attribute} \end{cases} \quad (1)$$

Where:

Rij = Normalized performance rating value

Max xij = The largest value of each criterion

Min xij = The smallest value of each criterion

xij = The attribute value of each criterion

The preference value for each alternative (Vi) is given as follows:

$$V_i = \sum_{j=1}^{n} w_j r_{ij} \quad (2)$$

Where rij is the normalized performance rating of alternative Ai on attribute Cj; i = 1, 2, ..., m and j = 1, 2, ..., n. Vi value indicates that alternative Ai is preferred. Steps in determining the SAW method are as follows:

a. Determine the criteria (Ci) that will be used as a reference in decision-making.
b. Determine the suitability rating of each alternative for each criterion.

c. Create a decision matrix based on the criteria (Ci), then normalize the matrix based on an equation adjusted for the attribute type (benefit attribute or cost attribute) to obtain a normalized matrix R.

The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix R with the preference weight vector, so that the largest value is obtained, which is selected as the best alternative, for example, (A1)

Questionnaire. This study used a purposive sampling technique because the researcher felt the sample selected was most knowledgeable about the problem being studied. In this study, 60 respondents were used. Respondents were service providers and stakeholders directly involved in the development activities. The respondent breakdown is as follows:

1. Implementing Contractors = 10 respondents,
2. Supervising Consultants = 10 respondents,
3. Consultant Planner = 10 respondents.
4. Auction Committee = 10 respondents,
5. Materials Supplier = 10 respondents,
6. Self-managed Organizer = 10 respondents.

Results and Discussion

Determination of Influential Factors. Based on the results of the first stage questionnaire that has been conducted, 10 factors were obtained that influence the implementation of rehabilitation activities with contractual and self-management, namely: Quality of work, Quantity of work, Time of work implementation, Reasonableness of price, Qualification of service provider, Experience of service provider, Value of work, Methodology of work implementation, Work administration and Work accountability.

Classification of Benefit Criteria and Cost Criteria. The benefit criterion indicates the attributes desired by the decision maker. The higher the value of this criterion, the better the alternative. Meanwhile, the cost criterion indicates the attributes the decision maker wants to minimize. The lower the value of this criterion, the better the alternative. The following are the classification results of the benefit and cost criteria based on the 10 factors collected in the first phase of the questionnaire.

Table 1. Criteria Classification

No.	Benefit Criteria	Cost Criteria
1.	Quality of work (S1)	Price Reasonability (S9)
2.	Quantity of work (S2)	Value of Work (S10)
3.	Time of work (S3)	
4.	Work methodology (S4)	
5.	Job accountability (S5)	
6.	Job administration (S6)	
7.	Service provider qualifications (S7)	
8.	Service provider experience (S8)	

Criteria Weighting. This stage was conducted using a second-stage questionnaire. Respondents assessed each criterion based on its level of influence on two types of rehabilitation activities. The following are the criteria scores determined by respondents, as follows:

Very High : 5

High : 4
Sufficient : 3
Low : 2
Very Low : 1

Furthermore, based on the results of the second-stage questionnaire, weights were obtained for each criterion, as outlined in the table below.

Table 2. Criteria Scores

Activity System	**Criteria**									
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**
Contractual	0.85	1	0.86	1	0.87	0.83	0.78	0.81	0.58	0.62
Self-Management	0.75	0.83	0.55	0.55	0.54	0.61	0.65	0.57	0.88	0.81

Afterward, each criterion was weighted. The weighting was based on the average of the choices for each of the two activity systems. This weighting indicates the criteria that most influence the two systems for procuring state-building rehabilitation services. The weighting of each criterion is outlined in the table below.

Table 3. Criteria Weighting

Criteria	**Weighting**
S1	0.23
S2	0.22
S3	0.12
S4	0.08
S5	0.06
S6	0.05
S7	0.02
S8	0.06
S9	0.08
S10	0.08
Total	**1.00**

The next step is to convert the criteria table into a matrix. The following is the resulting matrix based on the 10 criteria and two types of systems, each with its own usage trends.

Table 4. Criteria values in matrix form

R	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	0.85	1	0.6	1	0.87	0.83	0.78	0.81	0.58	0.62
2	0.75	0.83	0.7	0.55	0.54	0.61	0.81	0.57	0.88	0.81

Based on **Table 4** above, normalization was performed for the benefit and cost criteria. The results of the normalization for both types of criteria are presented in **Table 5** below.

Table 5. Normalized Criteria Values

R	1	2	3	4	5	6	7	8	9	10
1	1.00	1.00	0.86	1.00	1.00	1.00	0.96	1.00	1.00	1.00
2	0.88	0.83	1.00	0.55	0.62	0.73	1.00	0.70	0.66	0.77

After normalizing the two criteria, the next step is to determine the weighting of each state building rehabilitation implementation system. The weighting is done by multiplying the values in **Table 5** by the values in **Table 3**. The weighting of each implementation system is outlined in the table below.

Table 6. Selection Weighting

No.	Implementation System	Weighting
1	Self-Management	0.98
2	Contractual	0.80

Conclusion

Based on the analysis conducted using the SAW method on the state building rehabilitation system, the contractual system is more efficient. This is evident in the superiority of the contractual system in its more comprehensive benefit criteria. Furthermore, the contractual system has a lower weighting based on cost criteria.

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