

## Performance Analysis of Road and Bridge Planning Consultancy Services in SIGI District

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**ABSTRACT:** How well the consultant performs at the planning stage is measured by the quality of the designs and documents produced. To comprehend the primary variables of performance and approaches for enhancing planning consultants' performance on road and bridge projects in the Sigi Regency, research was conducted on 30 respondents including team leaders, experts, and clients. Data collection through questionnaire surveys and interviews and using relative rank index and multiple linear regression as data analysis methods. The research results show that realistic budget for the procurement of consulting services is the most dominant factor influencing the performance of road and bridge planning consultants in Sigi Regency, followed by knowledge of economic aspects, construction technology, materials and design; realistic time for implementation of consultancy services; understanding and compliance with applicable regulations; and planning methodology that considers the location and distance of material sources. Based on multiple linear regression analysis, every component significantly and exclusively affects planning consultants' performance. The approach of handling that can be used is increasing the capacity of expert through formal and non-formal education, involving planning consultants at the work proposal and construction stages and using building information modeling-based software.

**KEYWORDS** -performance of planning consultants, planning documents, roads, design stage

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### I. INTRODUCTION

Road work is one of the infrastructures that plays an important role in meeting community needs and has a positive and significant impact on regional economic growth in Sigi Regency. The longer the road is in good condition, the easier it will be for people to carry out economic activities, thereby encouraging regional economic growth [1]. If we look at the condition, only around 130 km of 1150 km district roads are in good condition, the rest are in fair condition and damaged. To cover the gap between road length and road good conditions, the Sigi Regency Government requires a very large budget for planning, construction and maintenance activities [2]. Due to budget limitations, the Sigi Regency Government is very dependent on financing schemes outside the general allocation fund (DAU) such as special allocation funds for roads (DAK), regional road instructions and palm oil profit sharing funds (DBH)[3]. Complete technical planning documents such as detailed engineering design (DED) and bill of quantities (BOQ) that comply with technical standards must be available when proposing work plans [4].

When road and bridge building projects are being implemented, issues including quality reduction, cost overruns, and delays in project completion frequently arise. [5]. Planning documents that do not match the kind of treatment with the requirements of the current field conditions are one of the reasons of difficulties that frequently arise, according to the literature that has been reviewed. Research on the variables influencing the performance of planning consultants and ways to resolve issues which come up in the Sigi Regency Public Works and Spatial Planning Department, the technical organization in charge of overseeing road and bridge operations, are necessary in regard to the issues that arise.

**II. LITERATURE REVIEW**

The following are some ideas and reviews of the literature that are relevant to and validate the research object.

**2.1 Performance of Road and Bridge Planning Consultancy Services**

Performance is the outcome of an individual's labor in terms of both quantity and quality, attained while performing their duties in compliance with the responsibilities assigned to them [5]. Performance is the entire value achieved from the stages of activities carried out by a person during a certain time interval [6]. The performance of planning consultants can be defined as the conformity between planning documents and the client's terms or expectations [7]. Based on the criteria agreed upon with the client, the quality of the design and documentation can be used to evaluate the performance of planning consultation services[8].

A number of attributes have been proposed by some studies as a way to assess consultants' achievement throughout the design stage[8], [9], [10].These attributes are quality of design, quality of drawing, accuracy of cost estimate, compliances to client’s terms and compliance to legislative requirements.

**2.2 Factors Affecting Planning Consultants' Performance**

A thorough study of the literature revealed multiple studies that discussed the variables influencing the performance of the planning consultant. [7], [8], [9], [10], [11], [12], [13], [14], [15]. Table 1 provides a summary of the criteria that have been identified.Twenty variables that affect a planning consultant's performance were found in the literature and categorized into four groups: method, cost, time, and human resources.

The variables listed in Table 1 were added to a survey that was meant to gather initial data for an empirical study.This paper's next section details the making of the questionnaire, data collection procedures, and conclusions drawn from the statistical analysis of the collected data.

**Table 1.** Factors influencingthe Performance of Planning Consultants

Major Factors	Attributes
X1 Method	X1.1 Consider the availability and capabilities of labor and equipment
	X1.2 Consider the location and distance of material sources
	X1.3 Consider the impact of planning on the environment and work safety
	X1.4 Design optimization
	X1.5 Use of BIM-based software
X2 Time	X2.1 Realistic time required for the design
	X2.2 Rational and systematic schedule preparation
	X2.3 Timely in completing survey data collection and field investigation
	X2.4 Timely in submitting complete documents at each planning stage
	X2.5 Timeliness of submission of final planning documents
X3 Cost	X3.1 Realistic consulting services project budget
	X3.2 Suitability of cost types to needs
	X3.3 Conformity of personnel cost calculation methods with regulations
	X3.4 Conformity of non-personnel direct cost calculation methods with regulations
	X3.5 Calculate the possible costs of additional work
X4 Human Resources	X4.1 Knowledge of economic aspects, construction technology, materials and design
	X4.2 Being aware of and abiding by the rules, laws, and regulations that apply
	X4.3 Ability to understand the characteristics and needs of clients
	X4.4 Ability in communication, coordination and consultation with stakeholders
	X4.5 Ability to identify, analyze potential and solve problems

**III. RESEARCH METHODS**

**3.1 Design of Questionnaires**

The results of the literature research were integrated into a use questionnaire as part of a quantitative methodology.The questionnaire survey was divided into three parts. Section A includes the respondents' demographic data.Section B, which included 20 factors, asked respondents to rate the degree to which the factors they identified affected the planning consultant's performance.The criteria were divided into four main categories: method, cost, time, and aspects pertaining to human resources.Section C sought to measures

achievements performance of planning consultant. A five-point Likert scale of importance was used to evaluate the survey's variables.

### **3.2 Method of Data Collection**

The population in this research includes consultancy service companies working on road and bridge planning in Sigi Regency and clients who come from technical agencies, namely the Sigi Regency Public Works and Spatial Planning Department. Subjects in this study include clients, experts, and team leaders who are qualified to remark on a range of design-related topics.

Using Pearson Correlation, validity testing is performed to assess the questionnaire's validity for each of its attributes [16]. The purpose of a reliability test is to ascertain whether the measuring tool is consistent and dependable enough to hold up over time when repeated measurements are made. [16]. The Cronbach's Alpha approach will be applied in this study.

### **3.3 Analysis of the data**

Descriptive statistics were obtained by analyzing survey data using the statistical analysis application SPSS 24. The descriptive approach is a way to explain or examine research findings, it is not meant to be used to draw further generalizations [16].

#### **3.3.1 Relative Rank Index**

The overall ranking of the influencing factors as perceived by the respondents was determined using Relative rank index [16]. The RRI score is calculated using the Equation (1).

$$RRI = \frac{1}{nN} \sum_{i=1}^n I_i x_i \quad (1)$$

where

n = highest number of scales

N = number of respondents

I = 1, 2, 3,.....

I<sub>i</sub> = likert scale where I<sub>1</sub> is the lowest scale and I<sub>n</sub> is the highest scale

x<sub>i</sub> = frequency of scale values chosen by respondents from i = 1 to i = n

#### **3.3.2 Multiple Regression Analysis**

When manipulating two or more independent variables as predictor factors, researchers can forecast the condition (up or down) of the dependent variable using multiple regression analysis [16]. The multiple regression analysis based on Equation (2) below.

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + e. \quad (2)$$

## **IV. RESULTS AND DISCUSSIONS**

The findings of the data gathered by an empirical survey are shown in the following sections. Thirty completed surveys were used for the research presented in this paper.

### **4.1 Characteristics of the Respondents**

As shown in Fig. 4.1, these respondents have substantial expertise in the construction industry, thus they were well-versed in the subject when they answered the survey. Considering the respondents' educational background is significant to this study, their primary qualifications as bachelor's, master's, associate's, and postgraduate degree are displayed in Fig. 4.1.

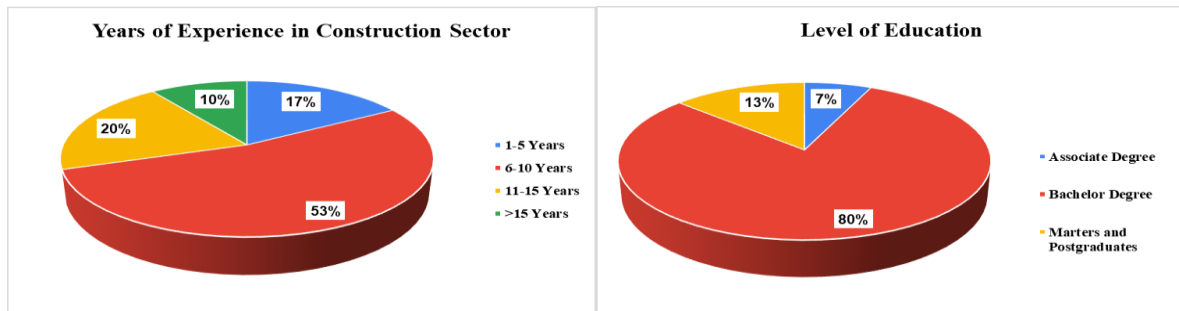


Figure 1. Demographic information

#### 4.2 Validity Test

The purpose of the validity test is to determine the validity of each item in the instrument. By compared the estimated r value with the table r value, one can determine the degree of correctness. It is clear from Fig. 2 that every question item is legitimate when r count > r table.

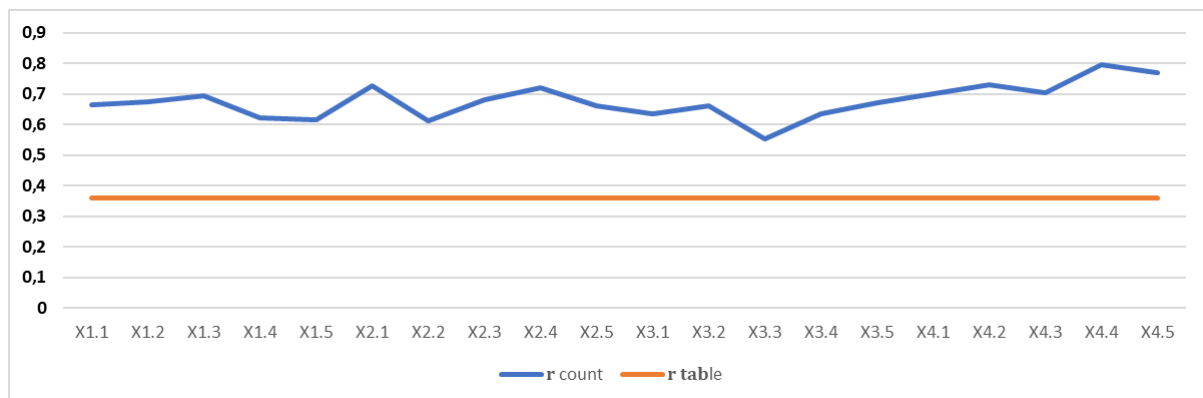


Figure 2. Graphic of validity test results

#### 4.3 Reliability Test

Tests of respondents' consistency and stability in responding to inquiries about the variables influencing planning consultants' performance were conducted.

Table 2. Reliability statistics

Number of factors	Cronbach's Alpha	Minimum Cronbach's Alpha Test Value	Interpretation
20	0,934	0.600	Good and very reliable

Table 2 indicates that, at the 5% significance level, the respondents' responses are very dependable or internally consistent, allowing for the collection of additional data.

#### 4.4 Relative Rank Index (RRI) Analysis

Table 3 presents the overall ranking of elements impacting planning consultants' performance based on respondents' perspectives. Relative ranking index analysis is the basis for this ranking. It shows that the key factors influencing performance of planning consultant are realistic consulting services project budget; knowledge of economic aspects, construction technology, materials and design; realistic time required for the design; being aware of and abiding by the rules, laws, and regulations that apply; and consider the location and distance of material sources.

A reasonable budget for consulting services was cited by respondents as the primary determinant of road and bridge planning consultants' success in Sigi Regency. According to the research done by [8] this is in line with the costs incurred for procuring consultancy services are directly proportional to the performance of

the planning consultant. Additionally, this is consistent with the study findings of [12], [13] who found that there is a close relationship between the budget for consulting services and the performance of planning consultants. The performance of planning consultants was influenced by the size of the budget[17], mainly because Planning consultants undervalued value engineering on low-cost work and did not devote enough effort to evaluating design possibilities.

**Table 3.**An overall ranking of the variables affecting planning consultants' performance

<b>Factors</b>	<b>RRI</b>	<b>Ranking</b>	<b>Variable</b>
Realistic consulting services project budget	0,953	1	Cost
Knowledge of economic aspects, construction technology, materials and design	0,940	2	Human resources
Realistic time required for the design	0,933	3	Time
Being aware of and abiding by the rules, laws, and regulations that apply	0,907	4	Human resources
Consider the location and distance of material sources	0,893	5	Method
Ability in communication, coordination and consultation with stakeholders	0,887	6	Human resources
Ability to identify, analyze potential and solve problems	0,880	7	Human resources
Use of BIM-based software	0,880	8	Method
Timeliness of submission of final planning documents	0,880	9	Time
Timely in submitting complete documents at each planning stage	0,880	10	Time
Consider the availability and capabilities of labor and equipment	0,873	11	Method
Ability to understand the characteristics and needs of clients	0,860	12	Human resources
Design optimization	0,853	13	Method
Rational and systematic schedule preparation	0,847	14	Time
Timely in completing survey data collection and field investigation	0,847	15	Time
Calculate the possible costs of additional work	0,840	16	Cost
Suitability of cost types to needs	0,840	17	Cost
Consider the impact of planning on the environment and work safety	0,820	18	Method
Conformity of personnel cost calculation methods with regulations	0,813	19	Cost
Conformity of non-personnel direct cost calculation methods with regulations	0,807	20	Cost

Knowledge of economic aspects, construction technology, materials and design was identified as the second most crucial element according to the replies. This is consistent with studies conducted by [15] and [18]who found that the knowledge of consultant experts regarding economic aspects, construction technology, materials and design influenced the performance of planning consultants. Knowledge of construction technology and materials makes it easier for consultants to consider the design selection and work methods used[19]. The planning consultant's lack of understanding of construction techniques and materials will affect the quality of planning documents [13].

Realistic time required for the design was identified as the third dominant factor influencing the performance of planning consultants by respondents. This is consistent with studies conducted by[20] which found that sufficient time duration will influence the performance of planning consultants. The time allocation factor is very important because the more time given to planning activities, the quality of design and planning documents will increase[21]. The overall quality of planning documents is impacted by unrealistic customer assumptions about the amount of time needed for design[10].

Being aware of and abiding by the rules, laws, and regulations that apply was identified as the fourth dominant factor influencing the performance of planning consultants. This is consistent with the findings of the research by[18] who found that understanding and compliance with laws, codes, regulations, and standards and regulations were the factors that most influenced the performance of planning consultants. Planning documents

have to take into account public health and safety, the environment, public facilities, and adherence to relevant laws, rules, codes of conduct, and policies[22].

The fifth dominant factor is considering the location and distance of material sources. This is consistent with the findings of the research by [7], [15] who found that consideration of material availability in the field influenced the performance of planning consultants. The characteristics of Sigi Regency Road work which still relies on material supplies, AMP and batching plants from Palu City and Donggala Regency means that the distance between material sources and the work location is relatively far. The need for materials in road and bridge construction is very high and around 50–60% of the estimated road construction costs are spent on purchasing and transporting building materials to the work site[23], so consideration of the location and distance of material sources is very important factor.

#### 4.5 Multiple Linear Regression Data Analysis

Planning aspects are the independent variables, and the performance of planning consultants is the dependent variable. Multiple linear regression is used to assess and predict the influence of these independent variables.

##### 4.5.1 Simultaneous Test (F Test)

The F test measures the equation's significance and is used to assess the degree to which the planning factors collectively affect the planning consultant's performance. Provided that the computed F value is more than F table, or the sig value is less than 0.05 [16]. Table 4 displays the simultaneous test (F test) findings for each variable question item in this study.

**Table 4.** Simultaneous test result

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	112,109	4	28,027	79,100	,000b
	Residual	8,858	25	,354		
	Total	120,967	29			

Based on Table 4, the sig value  $0.000 < 0.05$  and the calculated F value  $79.1 > 2.76$ , which implies that methodology, time, cost and human resource factors together influence the performance of planning consultants.

##### 4.5.2 Partial Test (T Test)

To determine how each independent variable influences the dependent variable separately, the T Test or Partial Test is used. Comparing the T count and T table with a significance value of less than 0.05 or more can be used to perform this test. Table 5 displays the partial test results (T test) for each variable question item in this study.

The sig value was found using Table 5 is  $0.000 < 0.05$  and the four primary components' T values exceed the T table. This means that individually the independent variables, methodology factors, cost factors, time factors, and human resource factors have a significant effect on the dependent variable the performance of planning consultants.

**Table 5.** Partial test results

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,359	1,317		,273	,787
	Method	,196	,060	,232	3,249	,003
	Time	,295	,059	,390	5,033	,000
	Cost	,249	,078	,231	3,182	,004
	Human Resources	,251	,068	,303	3,705	,001

#### 4.5.3 Coefficient of Determination (R<sup>2</sup>)

The degree to which the independent variable contributes to the dependent variable is indicated by the coefficient of determination (R<sup>2</sup>). The R-Square (R<sup>2</sup>) value, which ranges from 0 to 1, is displayed in the model summary table. A majority of the information required to forecast the dependent variable is provided by the independent variable if the value is near to 1. A decreasing R<sup>2</sup> value indicates that the independent variable's capacity to explain the dependent variable is rather limited.

Table 6. Model summary test result

Model	R	RSquare	Adjusted RSquare	Std. Error of the Estimate
1	,963a	,927	,915	,59525

Table 6 indicates that the R<sup>2</sup> value is 0.927, or 92.7%, which shows that methodology factors, cost factors, time factors, and human resource factors influence the performance of planning consultants by 92.7% or strong whereas additional independent variables not included in the research account for the remaining 7.3%.

#### 4.5.4 Multiple Linear Equations

Using multiple linear regression analysis, it is possible to demonstrate how much planning elements affect planning consultants' performance. The multiple linear regression equation, which is derived from Table 6, is as follows:

$$Y = 0.359 + 0.196 (\text{method}) + 0.295 (\text{time}) + 0.249 (\text{cost}) + 0.251 (\text{human resources}) \quad (3)$$

From the Equation (3) it can be explained as follows:

1. There is a positive sign for the constant value (a), namely 0.359. When there is a positive sign, the relationship between the independent (methodology, costs, time, human resources) and dependent variables (performance of planning consultants) is one-way.
2. For this method of analysis, the regression coefficient value is 0.196, meaning that method factors have a favorable impact on planning consultants' performance.
3. For this method of analysis, the regression coefficient value is 0.295, meaning that time factors have a favorable impact on planning consultants' performance.
4. For this method of analysis, the regression coefficient value is 0.249, meaning that costs factors have a favorable impact on planning consultants' performance.
5. For this method of analysis, the regression coefficient value is 0.251, meaning that human resources factors have a favorable impact on planning consultants' performance.

#### 4.5.5 Handling Strategies for Improving the Performance of Road and Bridge Planning Consultants

Planning consultants need to use handling methods to perform better in their work, and these strategies are designed to get over common roadblocks that arise while putting advisory service activities into practice. The handling approaches listed below are designed to enhance planning consultants' performance on road and bridge projects in the Sigi Regency, namely:

1. Increasing the capacity of planning consultant experts through formal and non-formal education.  
Training is a quick-turnaround form of education that puts an emphasis on application over theory to enhance abilities outside of the conventional educational system. [24]. Improving human resources requires appropriate training according to the vision, mission and targets to be achieved. Increasing the capacity of experts is directed at achieving mastery of skills, knowledge and abilities [24].
2. Involve planning consultants at the stage of proposing and implementing construction activities.  
The planning consultant is responsible for the clarity, completeness, feasibility of implementing the project design, correcting errors or omissions if they occur, during the Construction Phase [25]. By involving planning consultants at the construction stage, construction quality can be improved, and project can be completed on time and on budget [25].

### 3. Use of software based on Building Information Modeling (BIM)

To avoid design mistakes, it is important to understand and encourage the role of technology in project delivery. Performance improvement can be done by encouraging the use of BIM-based software programs that are compatible and able to integrate across different scientific disciplines, thereby enabling fast and effective communication[20]. Even though it is a new technology and is expensive, the use of BIM applications at the technical planning stage can prevent design errors, produce reliable bills of quantity and save resources, costs and time[26].

## V. CONCLUSION

Relying from the study findings that have been methodically examined in the preceding chapters, it can be inferred that:

A realistic budget for procurement of consultancy services is the most dominant factor influencing the performance of road and bridge planning consultants in Sigi Regency, followed by knowledge of economic aspects, construction technology, materials and design; realistic time for implementation of consultancy services; understanding and compliance with applicable regulations; and a planning methodology that considers the location and distance of material sources to the work site.

With a percentage of 92.7% or greater, multiple linear regression analysis demonstrates that all factors have a significant and unidirectional influence on the performance of planning consultants; the remaining 7.3% is explained by other independent variables not included in the study.

Another alternative managing technique is to use software based on building information modeling, involve planning consultants in the proposal and implementation stages of construction activities, and increase the ability of planning consultant experts through formal and non-formal education.

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