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Analysis of Influential Factors in E-Purchasing of Road Construction Work on Procurement Performance in Central Java Province

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***Abstract*—** Electronic procurement represents one of the forms of e-government application. The development of the e-procurement process consistently and continuously is expected to overcome weaknesses in procurement, including the implementation of e-purchasing, especially in the last five years. The implementation of e-purchasing was enhanced in Central Java, particularly in road construction work packages, due to the initiative of the Public Works Office of Bina Marga and Cipta Karya. As the number of procurements increases, it is essential to evaluate the implementation of these procurements. This research aims to identify factors that influence procurement performance using Structural Equation Modelling - Partial Least Square (SEM-PLS). This research identifies four dominant factors affecting procurement performance: project characteristics, provider experience, determining the winner and negotiating, and project implementation and maintenance period. Based on these findings, recommendations will be prepared to improve the performance of procurements.

***Keywords*—** e-purchasing, road construction work, procurement performance, SEM PLS.

I. INTRODUCTION

The implementation of e-government (electronic government) in Indonesia has become a priority in the modernization of administrative efficiency, the reduction of bureaucracy, the improvement of public service quality, and the strengthening of good governance. One form of implementation is the electronic procurement of government goods and services (e-procurement) [1]. The implementation of e-government in the procurement of government goods and services is intended to enhance transparency in the procurement process, stimulate competition in the provision of public services and healthy government administration, and improve the effectiveness and efficiency of the procurement process [2].

Regulations pertaining to the procedures and systems for the procurement of government goods and services in Indonesia are constantly evolving. The developments and changes that occur are influenced by various factors, including technological advances, discoveries related to procurement implementation, experience and learning from the implementation of previous regulations, and the goals and challenges faced by the government. The developments and changes are implemented consistently and continuously to enhance efficiency, transparency, accountability, and healthy competition, thereby ensuring the procurement of quality goods and services at affordable prices that can be accounted for in terms of physical, financial, and benefits to support the government's duties in serving the community [3].

One of the findings in e-procurement is the emergence of e-purchasing. The government has employed e-purchasing as an established practice to procure goods and services through electronic markets, where goods and services are purchased through electronic catalogs, online stores, and selected providers [4]. The implementation of e-purchasing in Indonesia has received particular attention through the development of a catalogue system by [5]. The use of e-purchasing is supported by [6], with a target of 90% by 2024, followed by an increase in business actors by at least 40%.

Central Java Province is among the five provinces with the most significant expenditure realisation in 2021 and 2022. The province's e-purchasing activity is noteworthy, with an average of 22.82%. Furthermore, Central Java Province is actively participating in increasing e-purchasing, with an increase in the e-purchasing percentage of 112.03%. The growth is considerable compared to DKI Jakarta Province (74.22%) and East Java Province (50.21%). Furthermore, the number of construction work procurement packages in Central Java Province is set to experience a significant increase in 2023, with the number of packages expected to increase by 35 times, from six packages to 205 packages. This is followed by

an increase in the budget to 152 billion rupiahs from only three billion rupiahs. Therefore, e-purchasing is considered a valid and accountable innovation, given the significant transactions and budgets for e-purchasing [7], especially in Central Java Province.

Despite the identification of e-procurement as a priority by public institutions, significant changes to procurement methods can create weaknesses that will significantly affect project sustainability. These weaknesses can be found in areas such as duration, control, and risk [8]. According to [9], there are several issues to be addressed in the implementation of e-procurement, including the price listed may not be the final price until the goods or services are ready to be used, the goods or services may not be fully available, and the information on the goods or services may still be incomplete. Furthermore, [10]suggests that the broad market access that can be reached in e-procurement may not be sufficient to reduce fraud in government procurement.

The level of implementation will influence construction implementation [11]. The increasing number of providers could affect the implementation of procurement. These providers offer goods or services with the same technical standards but at different prices, so service users must determine which service provider to choose according to work needs [12]. Service provider ratings are essential in helping consumers make the right decision when deciding on a provider. Users can provide direct assessments through a rating system based on experience with certain service providers. This rating covers various aspects, including service quality, timeliness, responsiveness, and overall satisfaction. The absence of ratings can have a negative impact on user experience and consumer trust [13]. Without ratings, consumers have difficulty assessing the reputation and reliability of service providers [14]. This assessment will identify suitable service providers for the project, not just those offering the lowest price [15].

It is paramount to guarantee the results of the provider's work in e-purchasing to foster trust between consumers and service providers [16]. On e-purchasing platforms, the guarantee of work results must often be reflected in procurement implementation. Assurance can take various forms, such as reviews and ratings from previous customers, professional certification or accreditation, and quality guarantees offered by service providers. Professional certification or accreditation ensures that the service provider has the requisite skills and knowledge in their field. Furthermore, a quality guarantee can provide additional protection for consumers, thereby confirming the involvement of service providers in providing optimal results [12].

These various factors will affect procurement performance, particularly in Central Java Province, where the procurement of road construction work via e-purchasing will only commence in 2022. Research conducted by [17]indicates that this necessitates an investigation into the government's experience in modifying the existing procurement process, including the identification of obstacles to electronic procurement, particularly within the construction sector [13]. Consequently, the objective of this research is to identify the key factors that influence the implementation of road construction work package procurement. Based on these factors, recommendations will be provided to enhance procurement performance.

II. LITERATURE REVIEW

A. E-Purchasing

Information and communication technology (ICT) represents one response to increasing global competition. The role of technology use has a significant influence on organisational operations [18]. One application that has emerged due to the role of technology is e-purchasing. According to [19], the definition of electronic purchasing, which is then called e-purchasing, is the procedure for purchasing goods/services through an electronic catalog system or online shop.

As outlined by [20], several factors drive the implementation of e-purchasing, including cost, time, and quality. The adoption of e-purchasing reduces inventory and workers, thereby reducing material, transaction, administrative, and strategic costs. Consequently, e-purchasing can facilitate a reduction in the time required for purchases, communication, evaluation, and fulfilment. By leveraging e-purchasing, organisations can enhance the quality of their supply chains through increased visibility, efficiency, and communication.

B. E-Catalogues

An electronic catalog (e-catalog) is the procedure for purchasing goods and services through the electronic catalog system, which is then regulated in [21]. The e-catalog contains goods, construction work, and other

services that meet specific criteria to be displayed in the e-catalog. Four criteria are required for the e-catalog: the exact specifications, the same seller/provider, the same sales area, and the same terms and conditions. The implementation of e-purchasing in the e-catalogues application is the responsibility of Commitment-Making Officials (PPK), Procurement Officials (PP), Providers, and Distributors. The general provisions for e-purchasing catalogues are as follows.

1. A catalog product is a good or service provided by an e-catalog provider listed in the electronic catalog with certain specifications and prices.
2. All Ministries, Institutions, and Regional Governments are permitted to purchase products listed in the catalogue, except those goods and services advertised in the catalogue advertising feature, which are otherwise subject to the relevant product review decisions.
3. The unit price displayed in the e-catalog represents the highest price available and can be purchased via e-purchasing.

C. Procurement Performance

The performance of the procurement process is related to the procurement performance and can impact the project performance. According to [22], procurement performance is influenced by several factors, including the procurement procedures, the capabilities of the procurement staff, and the information technology used in the procurement process. In contrast, [23]posits that the procurement method will influence the project's cost, quality, and time performance. Consequently, procurement performance is an organisational success factor in acquiring quality goods and services to provide excellent organisational services [24].

Several instruments can be used to assess performance quality, particularly in relation to services. One of these is the Service Quality (SERVQUAL). As outlined by [25], SERVQUAL is designed to assess user satisfaction in the short term and is sensitive to rapidly evolving factors. The SERVQUAL measurement dimensions encompass reliability, responsiveness, assurance, empathy, and tangibles.

1. Reliability: the capacity to fulfill work obligations and deliver results in accordance with user requests based on experience and reputation.
2. Responsiveness: the ability to respond to users who are influenced by expertise, behaviour, tools, and the provision of solutions.
3. Assurance (guarantee): the capacity to guarantee work results through competence and credibility, thereby gaining user trust.
4. Empathy: the capacity to demonstrate concern for users, enabling them to understand their needs through communication and interaction skills.
5. Tangibles (results): an assessment of the tangible outcomes delivered to users.

In [26], procurement performance is evaluated using Sink's seven-criteria model, with quality being one of the seven criteria. The variables influencing procurement performance include resource use, the implementation of process innovation, the qualification of results, and the selection of service providers. In addition, the following indicators influence the quality of procurement performance: the evaluation of procurement, the conformity of procurement results with contract specifications, and the selection and qualifications of service providers. A procurement initiative's success is evaluated according to the agreed specifications through negotiations, the selection of service providers, the evaluation of service providers, and the payment process [27].

III. METHODOLOGY

A review of the literature reveals nine factors that influence the performance of procurement operations. These are presented in Table 1. The nine factors will be analysed to ascertain their influence on procurement performance, defined as the accuracy of selecting service providers, the quality of procurement by service users, and the quality of work results. Each factor will be assigned a weight on each indicator using a Likert scale via a questionnaire to the respondents. The respondents in this research were 46 individuals employed in the Public Works Office of Bina Marga and Cipta Karya in Central Java province who were involved in procurement.

The data will be analysed using SEM-PLS with the SmartPLS 3.0 application. In accordance with the statement of Chin [28], the minimum sample size required to conduct research using the SEM-PLS is 30–100 respondents. The SmartPLS application is capable of producing reliable models despite the absence of numerous requirements [29]. One advantage of this application is that it can test predicted relationships

between research variables in complex modelling, especially if there are obstacles in the minimum sample size required. This minimum sample size can be achieved through bootstrapping or random doubling, a method employed by SmartPLS. Furthermore, the application is more efficient and easier to interpret.

Table 1. *Research Variable*

Variables	ID	Indicators	References
Project Characteristic	X1.1	The complexity of the work performed	[8], [14], [30], [31]
	X1.2	A complete explanation of the scope of work	[8], [14], [32]
	X1.3	Clarity of job specifications that need to be met	[8], [14], [32]
	X1.4	Complexity of project implementation locations	[8], [14]
	X1.5	Complete information on field conditions for project implementation	[8], [14]
Provider Administration Completeness	X2.1	Completeness of provider data information displayed in the e-purchasing application	[7], [13], [33]
	X2.2	Validity of provider organization profile information	[12], [14], [30]
	X2.3	Provider's track record in procurement (legal status)	[12], [14], [30]
Provider's Technical Equipment	X3.1	Have expert staff with appropriate competence and experience	[12], [14], [34]
	X3.2	Fulfillment of equipment in good condition	[12], [30]
	X3.3	Fulfillment of the amount of material stock according to the required specifications	[12], [30], [31]
Provider's Experience	X4.1	Have experience in carrying out similar work	[12], [30], [35]
	X4.2	There is work being carried out elsewhere	[12], [30]
	X4.3	Have carried out mock-ups / product/service introductions	[12], [36]
	X4.4	Dispute with a service user	[12], [14]
Determination of Price Selection	X5.1	Accuracy of service users in estimating work costs	[12], [14], [30]
	X5.2	Up-to-date information about price references	[7], [31], [36]
	X5.3	The tendency of service users to choose the lowest price	[8], [31]
Determining the Winner and Negotiations	X6.1	Consistency of evaluation criteria for selecting service providers	[32], [36], [37]
	X6.2	The number of providers to choose from is appropriate to the work.	[13], [32], [38]
	X6.3	Competence of procurement personnel in determining the winner	[13], [34], [35]
	X6.4	The tendency of service users toward certain service providers	[8], [31], [39]
	X6.5	Smooth communication in the procurement negotiation process	[7], [13], [31], [34]
	X6.6	Completeness of the report on the implementation of the procurement process and results	[34], [39]
Creation and Issuance of Contracts	X7.1	Clarity of the agreement in the contract	[7], [32], [37]
	X7.2	Completeness of deliverables requirements and acceptance criteria	[31], [32], [36]
	X7.3	Firmness in providing sanctions for service provider negligence	[32], [34], [37]
Work implementation	X8.1	The level of involvement of service users in carrying out work	[12], [32], [37]

	X8.2	The provider's response to the service user's directions	[12]
	X8.3	Collaboration between users and service providers	[12], [38]
	X8.4	Commitment to additional work during contract implementation	[8], [12], [31]
	X8.5	Completeness of service provider performance reports as quality control (suitability of targets and work realization)	[12], [31], [39]
Contract Completion and Maintenance Period	X9.1	Service provider compliance with the work contract	[12], [31], [36]
	X9.2	Assessment of work produced by service providers (quality of work results and conformity to specifications)	[12], [30], [40]
	X9.3	Timeliness of payment for work by service users	[31], [34], [39]
	X9.4	Minimal contract disputes in completing work	[31], [37], [38]
	X9.5	Commitment and responsibility of the service provider during the maintenance period	[12], [40]
Procurement Performance	Y1	Accuracy of provider selection	[12], [32], [38]
	Y2	Procurement Quality	[12], [38], [39]
	Y3	Work Quality	[12], [37], [39]

Following the application of SEM-PLS, the dominant indicators influencing procurement performance were identified. In light of these findings, a further literature study was conducted to identify the most appropriate responses to enhance procurement performance. The recommendations will be subjected to expert validation. Expert validation is collected through questionnaires regarding recommendations that can be used to improve procurement performance. The questionnaires include optional and open-ended questions. The experts at this stage consist of government goods and services procurement practitioners from the bureaucracy who have been certified in goods and services procurement. The experts in question have accumulated over fifteen years of professional experience and are engaged in road construction.

IV. RESULTS AND DISCUSSION

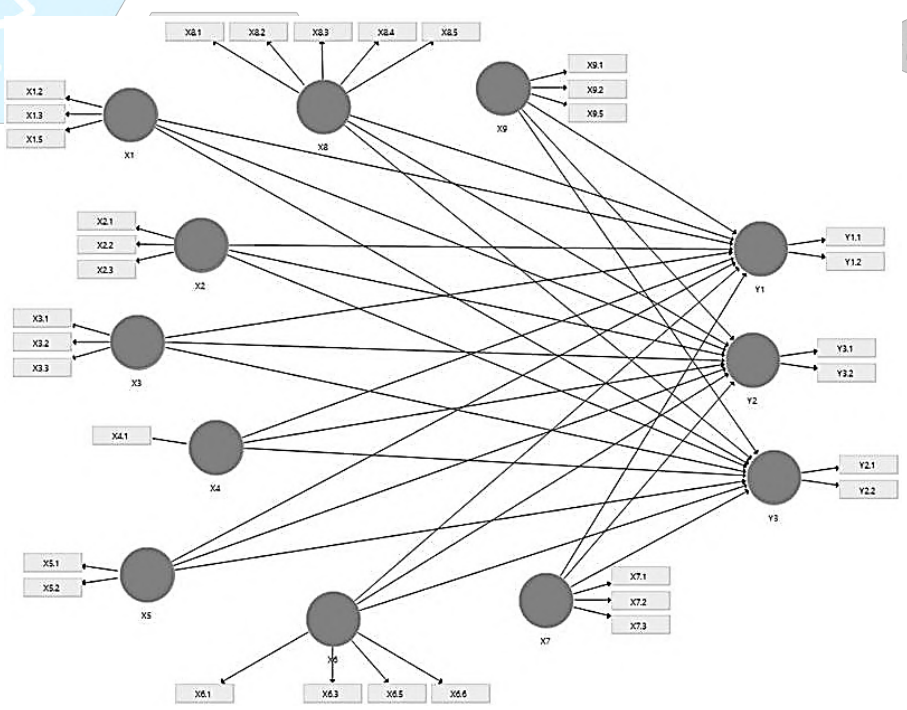

Fig. 1. *SEM PLS Modeling*

The analysis in Smart PLS 3.0 is conducted using a modelling approach that employs variables depicted by blue circles and indicators depicted by yellow boxes. The arrows in Fig. 1 illustrate the paths and models of relationships between variables and between variables and indicators. This research employs a reflective measurement model whereby indicators represent a variable [41]. Consequently, the direction of the arrow from the variable to the indicator indicates the assumption that the variable will be measured through the indicator.

A. Outer Model Evaluation

The outer model defines the relationship between variables and their respective indicators. In the reflective model, the tests include indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

1. Convergent Validity

Convergent validity is defined as the principle that the measures of a variable should be highly correlated. The conventional wisdom regarding convergent validity suggests that an outer loading value of at least 0.7 indicates satisfactory convergence. In order to demonstrate convergent validity, the Average Variance Extracted (AVE) value must exceed 0.5. The initial calculation revealed that several variables exhibited an AVE value below 0.5, while several indicators exhibited an outer loading below 0.7. This result indicates that the indicators are not valid for measuring the variables. It is recommended that invalid indicators with low outer loading values be removed from the measurement model [41]. The re-estimation process involves the elimination of invalid indicators. The second calculation indicates that all indicators and variables have met the requisite standards, as evidenced by Table 2.

Table 2. *Outer Loading Values*

Variabel	Indikator	Outer Loading	AVE
X1	X1.2	0.865	0.745
	X1.3	0.876	
	X1.5	0.849	
X2	X2.1	0.782	0.676
	X2.2	0.904	
	X2.3	0.775	
X3	X3.1	0.896	0.780
	X3.2	0.898	
	X3.3	0.854	
X4	X4.1	1.000	1.000
X5	X5.1	0.917	0.740
	X5.2	0.799	
X6	X6.1	0.813	0.649
	X6.3	0.815	
	X6.5	0.779	
	X6.6	0.816	
X7	X7.1	0.903	0.742
	X7.2	0.882	
	X7.3	0.796	
X8	X8.1	0.814	0.744
	X8.2	0.906	
	X8.3	0.900	
	X8.4	0.850	
	X8.5	0.839	
X9	X9.1	0.814	0.647
	X9.2	0.856	
	X9.5	0.737	
Y1	Y1.1	0.932	0.871
	Y1.2	0.934	

Y2	Y2.1	0.943	0.907
	Y2.2	0.947	
Y2	Y3.1	0.951	0.893
	Y3.2	0.954	

Table 3. *Cronbach's Alpha and Composite Reliability Values*

Variables	Cronbach's Alpha	Composite Reliability
X1	0.829	0.898
X2	0.761	0.862
X3	0.861	0.914
X4	1.000	1.000
X5	0.660	0.850
X6	0.821	0.881
X7	0.826	0.896
X8	0.913	0.936
X9	0.726	0.846
Y1	0.852	0.931
Y2	0.898	0.951
Y3	0.881	0.944

2. Reliability

A reliability test is employed to ascertain that a measurement is free from bias and guarantees consistent measurements. This test can be conducted in SEM PLS using Cronbach's Alpha and Composite Reliability [41]. Cronbach's Alpha quantifies the lower limit of the reliability value for a variable and is deemed acceptable if the value exceeds 0.6. Composite Reliability gauges the actual reliability value of a variable and is deemed satisfactory if the value exceeds 0.7. Table 3 demonstrates that all variables meet the requisite standards, indicating that the indicators employed to measure the variables in this research are reliable.

3. Discriminant Validity

This test is based on the principle that the measures of a variable are unique in that they are entirely distinct from indicators of other variables [41]The cross-loading values indicate the extent to which each indicator block loads the measured variable.

As illustrated in Table 4, the gray block represents the highest value produced by an indicator for its variable. Another test is the Fornell-Larcker Criterion, which identifies the variable with the greatest AVE root value. Table 5 presents the results of the Fornell-Larcker Criterion, which identifies the most significant AVE root value, as indicated by the gray block. The two measurements demonstrate that the indicators are valid for measuring the variables.

B. Inner Model Evaluation

Following the completion of the validity and reliability testing phases, the inner model is evaluated to determine the relationship between variables. The evaluation is based on the coefficient of determination and the path coefficient.

1. Coefficient of Determination (R2 Test)

The R2 value is a statistical measure that quantifies the degree of variation in the relationship between an independent and dependent variable. The value of the R2 coefficient indicates the extent to which the independent variable affects the dependent variable. A higher value indicates a more accurate prediction model for the proposed research model [42].

In this test, the R2 value of the Service Provider Selection Accuracy variable (Y1) is 84%. In other words, the variable Y1 can be explained by 84% of the independent variables, with the remaining 16% being explained by other variables not included in the model. Meanwhile, the Procurement Quality variable (Y2) is 58.8%, and the Work Quality (Y3) is 78.1%. Furthermore, the R2 value is used to calculate Q2 (Goodness of Fit), which determines the overall suitability of the model [41]. The Q2 value indicates the degree of explanation of the dependent variable. The following calculation was used to measure this study's Goodness of Fit (GOF).

$$Q^2 = 1 - (1 - R_1{}^2)(1 - R_2{}^2)(1 - R_3{}^2)$$

$$Q^2 = 1 - (1 - 0.840^2)(1 - 0.588^2)(1 - 0.781^2)$$

$$Q^2 = 0.985$$

Table 4. *Cross Loading Values*

	X1	X2	X3	X4	X5	X6	X7	X8	X9	Y1	Y2	Y3
X1.2	0.865	0.662	0.476	0.244	0.515	0.596	0.623	0.609	0.476	0.588	0.449	0.615
X1.3	0.876	0.681	0.517	0.308	0.403	0.557	0.568	0.465	0.384	0.564	0.435	0.564
X1.5	0.849	0.595	0.461	0.236	0.507	0.586	0.671	0.500	0.445	0.604	0.493	0.588
X2.1	0.582	0.782	0.604	0.338	0.576	0.580	0.595	0.452	0.546	0.500	0.333	0.477
X2.2	0.722	0.904	0.612	0.443	0.479	0.644	0.637	0.591	0.602	0.673	0.618	0.641
X2.3	0.520	0.775	0.544	0.448	0.329	0.530	0.389	0.429	0.571	0.477	0.434	0.520
X3.1	0.486	0.628	0.896	0.261	0.369	0.636	0.552	0.536	0.686	0.540	0.563	0.661
X3.2	0.509	0.645	0.898	0.313	0.257	0.579	0.492	0.460	0.595	0.408	0.485	0.497
X3.3	0.497	0.609	0.854	0.248	0.384	0.610	0.519	0.468	0.422	0.425	0.389	0.477
X4.1	0.303	0.500	0.309	1.000	0.378	0.503	0.488	0.376	0.475	0.424	0.362	0.266
X5.1	0.556	0.575	0.340	0.333	0.917	0.687	0.673	0.604	0.498	0.706	0.521	0.607
X5.2	0.367	0.344	0.322	0.323	0.799	0.483	0.566	0.368	0.240	0.452	0.319	0.445
X6.1	0.628	0.564	0.489	0.477	0.825	0.813	0.769	0.740	0.492	0.798	0.554	0.687
X6.3	0.420	0.515	0.532	0.484	0.506	0.815	0.663	0.601	0.585	0.573	0.387	0.471
X6.5	0.506	0.572	0.511	0.370	0.432	0.779	0.485	0.658	0.528	0.697	0.621	0.638
X6.6	0.578	0.628	0.692	0.300	0.445	0.816	0.615	0.587	0.605	0.618	0.577	0.682
X7.1	0.585	0.605	0.498	0.511	0.584	0.759	0.903	0.785	0.641	0.705	0.481	0.559
X7.2	0.701	0.683	0.568	0.464	0.751	0.739	0.882	0.696	0.538	0.652	0.566	0.640
X7.3	0.571	0.386	0.455	0.256	0.517	0.505	0.796	0.527	0.430	0.541	0.412	0.458
X8.1	0.627	0.611	0.427	0.371	0.565	0.692	0.763	0.814	0.595	0.694	0.527	0.516
X8.2	0.499	0.465	0.517	0.315	0.526	0.755	0.721	0.906	0.673	0.727	0.630	0.627
X8.3	0.521	0.503	0.455	0.273	0.478	0.692	0.712	0.900	0.648	0.706	0.562	0.595
X8.4	0.541	0.464	0.511	0.219	0.398	0.614	0.608	0.850	0.479	0.641	0.564	0.464
X8.5	0.452	0.570	0.489	0.434	0.553	0.727	0.584	0.839	0.638	0.745	0.605	0.561
X9.1	0.455	0.541	0.410	0.399	0.391	0.548	0.524	0.601	0.814	0.638	0.625	0.559
X9.2	0.465	0.675	0.566	0.444	0.456	0.582	0.537	0.552	0.856	0.603	0.568	0.635
X9.5	0.283	0.446	0.629	0.292	0.231	0.514	0.451	0.555	0.737	0.518	0.469	0.535
Y1.1	0.654	0.621	0.550	0.270	0.653	0.785	0.661	0.712	0.707	0.932	0.702	0.873
Y1.2	0.614	0.648	0.432	0.520	0.644	0.793	0.717	0.811	0.660	0.934	0.701	0.729
Y2.1	0.683	0.637	0.542	0.295	0.624	0.715	0.591	0.585	0.651	0.837	0.943	0.680
Y2.2	0.609	0.633	0.645	0.209	0.556	0.763	0.632	0.631	0.705	0.785	0.947	0.778
Y3.1	0.487	0.491	0.477	0.329	0.465	0.641	0.491	0.622	0.632	0.703	0.727	0.951
Y3.2	0.527	0.612	0.573	0.360	0.499	0.648	0.593	0.656	0.687	0.728	0.744	0.954

Table 5. *Fornell-Larcker Criterion Values*

	X1	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**Y1**	**Y2**	**Y3**
X1	0.863											
X2	0.748	0.822										
X3	0.561	0.710	0.883									

	X1	X2	X3	X4	X5	X6	X7	X8	X9	Y1	Y2	Y3
X4	0.303	0.500	0.309	1.000								
X5	0.552	0.555	0.383	0.378	0.860							
X6	0.672	0.712	0.690	0.503	0.696	0.806						
X7	0.721	0.662	0.592	0.488	0.724	0.786	0.862					
X8	0.609	0.605	0.557	0.376	0.586	0.809	0.785	0.863				
X9	0.505	0.695	0.657	0.475	0.454	0.682	0.629	0.707	0.804			
Y1	0.679	0.680	0.526	0.424	0.695	0.846	0.739	0.816	0.732	0.933		
Y2	0.533	0.580	0.552	0.362	0.506	0.677	0.570	0.671	0.693	0.751	0.953	
Y3	0.683	0.672	0.629	0.266	0.624	0.783	0.647	0.644	0.717	0.857	0.772	0.945

The aforementioned calculations have yielded a Q2 value of 0.985. This calculation indicates that the variables included in the model can explain 98.5% of the model's overall outcome, with the remaining 1.5% being attributed to other variables that are not included. This research model is of excellent quality, as evidenced by the Q2 value exceeding 60%.

2. Path Coefficient

The path coefficient value indicates the degree of association between variables in the structural model. The bootstrapping test will demonstrate the t-statistic value, indicating the degree of significance. A t-statistic value of greater than 1.96 indicates a significant relationship, while a value below 1.96 does not indicate a significant relationship [42]. As presented in Table 6, the analysis results indicate that four variables have t-statistic values exceeding 1.96. The four factors identified as significant are X1 (project characteristics), X4 (provider experience), X6 (determination of the winner and negotiation), and X9 (contract completion and maintenance period). These factors influence procurement performance in terms of aspects Y1 (accuracy of provider selection) and Y3 (work quality).

Table 6. *Coefficient Path Values*

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
X1 -> Y1	0.183	1.234	0.218
X1 -> Y2	0.168	0.803	0.422
X1 -> Y3	0.290	2.034	0.042
X2 -> Y1	0.030	0.185	0.853
X2 -> Y2	-0.083	0.397	0.691
X2 -> Y3	-0.047	0.302	0.763
X3 -> Y1	-0.225	1.781	0.075
X3 -> Y2	0.080	0.395	0.693
X3 -> Y3	-0.011	0.085	0.932
X4 -> Y1	-0.047	0.483	0.629
X4 -> Y2	0.022	0.140	0.889
X4 -> Y3	-0.239	1.968	0.049
X5 -> Y1	0.175	1.314	0.189
X5 -> Y2	0.153	0.744	0.457
X5 -> Y3	0.188	1.239	0.216
X6 -> Y1	0.445	2.406	0.016
X6 -> Y2	0.170	0.553	0.581
X6 -> Y3	0.553	2.289	0.022
X7 -> Y1	-0.115	0.616	0.538
X7 -> Y2	-0.245	0.897	0.370
X7 -> Y3	-0.107	0.564	0.573
X8 -> Y1	0.239	1.614	0.107
X8 -> Y2	0.254	0.732	0.464

X8 -> Y3	-0.229	1.221	0.222
X9 -> Y1	0.310	2.338	0.020
X9 -> Y2	0.391	1.679	0.093
X9 -> Y3	0.492	3.433	0.001

Table 7. *F2 Value*

Variabel	**f Square**		
	Y1	Y2	Y3
X1	0.064	0.021	0.117
X2	0.001	0.004	0.002
X3	0.108	0.005	0.000
X4	0.008	0.001	0.148
X5	0.072	0.021	0.061
X6	0.219	0.012	0.247
X7	0.017	0.029	0.010
X8	0.082	0.036	0.055
X9	0.200	0.124	0.369

Of the four factors under consideration, three exert a positive influence, while one exerts a negative influence. The positive influence factors are project characteristics, determining the winner and negotiating, and contract completion and maintenance periods. The contract completion factor and the maintenance period have the most decisive influence. In contrast, provider experience is the only factor with a negative influence and the factor with the lowest level of influence.

Tables 6 and 7 demonstrate the comprehensive influence of these variables on Y1 and Y3, respectively. It is first necessary to note that variable X1 exerts a significant and positive influence on Y3, with an influence level of 36.9%. Furthermore, variable X4 exerts a significant influence in a negative direction on Y3, resulting in a decrease of 14.8%. In addition, variable X6 exerts a significant and positive influence on Y1, amounting to 21.9%, and on Y3, amounting to 24.7%. Additionally, variable X9 exerts a positive influence on Y1 (20%) and Y3 (36.9%). These findings demonstrate the significance of these variables in elucidating the variability in Y1 and Y3, as well as the direction of their influence, which must be considered in the broader analysis context.

C. Recommendation for Improving Procurement Performance

The findings of the literature studies, which were based on the dominant factors, led to the formulation of recommendations for enhancing procurement performance. The final stage of expert validation involved receiving responses to the existing recommendations. The expert validation results indicate that there are recommendations concerning a common understanding of project characteristics between the parties involved in the project and the necessity for standard operating procedures (SOP).

A comprehensive explanation of the project scope, clarity of work specifications, and complete information regarding field conditions will facilitate understanding the project's characteristics. Service users must fulfil this completeness and clarity to understand the project's needs and challenges and focus on the most important and relevant aspects to the project's success. Collaboration between the planning department, PPK, PP, and the project department in preparing planning documents will help to ensure a comprehensive understanding of the project's characteristics. The document describes the background, objectives, scope, required input, implementation method, and expected results from an activity.

A profound comprehension of project attributes is of paramount importance for the overall success of a project. By focusing on this, service users can circumvent miscommunication, enhance risk management, elevate the quality of outcomes, and augment the overall efficiency and effectiveness of the

project. A lucid and robust comprehension enables service users to articulate their needs in greater detail and specificity to the service provider. Furthermore, service users can provide input to service providers during the execution of work. The establishment of a robust collaborative relationship between service users and providers can enhance the probability of attaining satisfactory outcomes for all parties involved and mitigate the potential for misunderstandings that could impede the project's progress.

Service users will be able to plan projects more efficiently by considering potential risks from the outset and developing risk management strategies. This will enable them to identify the optimal way to complete the project, thereby reducing the negative impacts that may occur and increasing the chances of its success. Therefore, developing a solid understanding of project characteristics is a top priority for every party involved in project management. Standard operating procedures (SOPs) are necessary to create consistency and uniformity in every process step, improving the organisation's quality.

V. CONCLUSION

In analysing the implementation of road construction work procurement using e-purchasing, four dominant factors influence procurement performance: project characteristics, provider experience, determination of winners and negotiations, and contract completion and maintenance periods. The determination of the winner, the negotiation process, and the finalisation of the contract and maintenance period influence the accuracy of the selection of service providers. The quality of the work is influenced by several factors, including the project characteristics, the experience of the service providers, the determination of the winners and the negotiations, the completion of the contract, and the maintenance period.

The contract completion and maintenance period factors exert the most significant favourable influence on work quality, with an influence value of 36.9%. Conversely, provider experience is the sole factor with a significant negative impact and the factor with the most minor influence, with an influence value of 14.8%. In light of the dominant factors that influence procurement performance, recommendations are required to address these factors and improve procurement performance. Expert validation has revealed that the most crucial action is to gain an understanding of the project's characteristics and the necessity of implementing standard operating procedures for the execution of road construction work via e-purchasing.

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