Quest Journals
Journal of Architecture and Civil Engineering
Volume 11 ~ Issue 7 (July 2026) pp: 94-100
ISSN(Online): 2321-8193
www.questjournals.org

Research Paper

Effect of Open Tendering and E-Catalog Procurement on Road Construction Service Provider Performance in East Kalimantan, Indonesia

Dewi Asnah[1], Nusa Sebayang[2], Erni Yulianti[3*]
[1,2,3] *(Master Program of Construction Management, Postgraduate Program, Institut Teknologi Nasional, Malang, Indonesia)*
Corresponding Author: Erni Yulianti

ABSTRACT : *Public road construction in East Kalimantan requires procurement arrangements that balance competition, speed, accountability, and contractor performance. This study evaluates the effects of open tendering and Indonesia's electronic catalog (E-Catalog/E-Katalog) procurement on five dimensions of road construction service provider performance: work quality, schedule performance, cost efficiency, administration and management, and safety and regulatory compliance. A quantitative explanatory survey produced 42 valid responses from construction service providers and public project personnel involved in government road projects. The six-point Likert instrument was screened using corrected item-total correlations and Cronbach's Alpha, followed by descriptive analysis, multivariate assumption tests, multivariate analysis of variance (MANOVA), and Tests of Between-Subjects Effects. Because multivariate normality was not fully satisfied and one performance dimension showed heterogeneous variance, Pillai's Trace was used as the robust multivariate criterion. Open tendering had a significant multivariate effect on provider performance ($V = 0.376$; $F(5,35) = 4.125$; $p = 0.004$), while E-Catalog procurement produced a stronger effect ($V = 0.421$; $F(5,35) = 5.088$; $p = 0.001$). Open tendering significantly affected quality, time, and cost, whereas E-Catalog significantly affected quality, time, cost, and safety/compliance. Neither method significantly explained administration and management performance. The findings show that procurement method is a managerial determinant of contractor outcomes. E-Catalog is particularly suitable for standardized and time-sensitive work, while open tendering remains important for complex projects requiring broad competition and technical evaluation.*

KEYWORDS: *Construction performance, e-catalog, e-procurement, MANOVA, open tendering, public road projects.*

*Received 14 July., 2026; **R**evised 26 July, 2026; **A**ccepted 28 July, 2026 © The author(s) 2026.*
P**ublished with open access at **www.questjournals.org

I. INTRODUCTION

Public procurement is a decisive component of infrastructure delivery because it converts public budgets into contractual relationships, technical outputs, and services for society. In road construction, procurement decisions affect not only the selection of a contractor, but also the allocation of risk, the speed of mobilization, the degree of competition, the quality of technical evaluation, and the accountability of project implementation. These issues are particularly important in East Kalimantan, where rapid infrastructure development and dispersed project locations place pressure on public agencies and service providers to deliver reliable road assets within constrained time and cost targets [1].

Indonesia uses several electronic and competitive procurement mechanisms. Open tendering offers broad access to qualified bidders and applies sequential administrative, technical, and price evaluation. Its principal strengths are competition, transparency, and the opportunity to test contractor capability before award. Nevertheless, the process can require substantial preparation and evaluation time, and unsuccessful or repeated tenders may postpone project mobilization. By contrast, E-Catalog procurement uses e-purchasing from providers and items already listed in a national electronic catalog. This method can shorten the selection process and improve price and specification visibility, although its performance depends on catalog coverage, competition among registered providers, and post-award control.

Procurement system design has been associated with project performance, sustainability, collaboration, and socioeconomic outcomes. Tang et al. showed that procurement integration and stakeholder interaction influence the success of sustainable building projects [2]. Laryea and Watermeyer argued that procurement strategy can be deliberately structured to achieve wider development objectives through packaging, targeting, and performance clauses [3]. In public construction, the selected method should therefore be evaluated as a project-governance instrument rather than a purely administrative procedure.

Contractor performance is multidimensional. Quality, time, and cost remain central indicators, but effective public construction also requires complete contract administration, responsive coordination, occupational safety, environmental compliance, and adherence to statutory requirements [4-6]. A procurement method may improve one dimension while creating trade-offs in another. Faster selection does not automatically guarantee better technical execution, while a highly competitive tender does not necessarily ensure prompt mobilization or effective post-award management.

Previous studies commonly compare procurement methods using procedural duration, bid prices, competition levels, or qualitative assessments. Fewer studies test their simultaneous influence on several provider-performance dimensions, particularly for road construction projects at the provincial level in Indonesia. This gap is important because the effect of procurement is likely to be distributed across correlated outcomes. A multivariate approach can evaluate the combined effect while also identifying the individual dimensions that respond most strongly.

This study compares open tendering and E-Catalog procurement in government road projects in East Kalimantan. It addresses three objectives: to test the multivariate effect of open tendering on provider performance; to test the multivariate effect of E-Catalog procurement; and to identify the performance dimensions that are significantly associated with each method. The study contributes empirical evidence for method selection and develops practical recommendations for aligning procurement strategy with project complexity, standardization, urgency, and risk.

II. LITERATURE REVIEW

2.1. Open Tendering and E-Catalog Procurement

Open tendering is based on public announcement, equal opportunity, bidder qualification, and competitive evaluation. In construction projects, a well-designed tender can increase market contestability and strengthen the owner's ability to evaluate experience, personnel, equipment, methodology, and price. Contractor-selection research emphasizes that award decisions should balance price with technical, organizational, financial, and safety capabilities because low-price selection alone may transfer substantial performance risk to the construction stage [7].

E-Catalog procurement is a digital purchasing mechanism in which product or service information, technical specifications, prices, and registered providers are available electronically. Its principal managerial advantage is the reduction of transaction steps between demand identification and contract award. Digital procurement can improve traceability and information access, but it must be accompanied by effective competition, specification control, and provider-performance monitoring to maintain value for money [8].

The two methods differ in their operational mechanisms. Open tendering relies on ex ante competition and evaluation, whereas E-Catalog relies more strongly on standardized information, pre-listed providers, and transaction efficiency. Consequently, open tendering may be preferable for complex, high-risk, or non-standard work, while E-Catalog may be advantageous for repeatable work packages with stable specifications and urgent implementation needs. These propositions must be examined empirically because the final outcome also depends on project management after contract award.

Table 1. Expected performance mechanisms of the procurement methods

Procurement Method	Principal Mechanism	Potential Performance Benefit	Main Control Requirement
Open tendering	Broad competition and detailed bidder evaluation	Technical quality, competitive price, accountability	Realistic procurement schedule and balanced technical-price evaluation
E-Catalog	Electronic purchasing from listed providers and standardized information	Faster selection, price visibility, operational continuity	Catalog competition, specification verification, and post-award monitoring

2.2. Construction Service Provider Performance

Construction performance is traditionally assessed through the interaction of time, cost, and quality. Cost and schedule deviations can propagate through resource allocation, claims, public service disruption, and stakeholder dissatisfaction [9]. Quality performance includes conformity with technical specifications, low rework, testing compliance, and user acceptance [10]. These outcomes are connected: accelerated work can affect quality and safety, while rework increases both duration and cost.

Public projects also require administrative and regulatory performance. Providers must prepare progress reports, payment documents, measurement records, change documentation, and correspondence in accordance with contract requirements. Safety and compliance depend on management commitment, competent personnel, hazard control, and adherence to construction regulations. Human and organizational factors therefore complement technical indicators in a comprehensive performance assessment [6].

2.3. Conceptual Model and Hypotheses

The conceptual model treats perceived implementation of open tendering (X1) and E-Catalog procurement (X2) as explanatory constructs. Provider performance is represented by five correlated outcomes: work quality (Y1), schedule performance (Y2), cost efficiency (Y3), administration and management (Y4), and safety and regulatory compliance (Y5). The multivariate hypotheses state that each procurement construct has a statistically significant effect on the combined performance vector. Follow-up univariate tests determine which individual dimensions account for the multivariate effect.

III. RESEARCH METHOD

3.1. Research Design and Sample

The study used a quantitative, explanatory, and comparative survey design. The research context comprised government road construction projects implemented in East Kalimantan during the 2019-2024 period. Projects were selected purposively when the physical work had been completed, the contract value exceeded IDR 500 million, the procurement method was open tendering or E-Catalog, and sufficient procurement and project-evaluation records were available. The final dataset contained 42 valid questionnaires, consistent with the residual degrees of freedom used in the multivariate and univariate tests.

Respondents were personnel with direct experience in procurement or project delivery, including construction service providers, commitment-making officials, project managers, site engineers, and field supervisors. Primary questionnaire data were supported by secondary information from the public procurement planning and electronic procurement systems and from project contract documents. The use of experienced respondents was intended to ensure that assessments reflected observed procurement and implementation conditions.

3.2. Variables and Instrument

The questionnaire used a six-point Likert scale. Open tendering and E-Catalog were initially measured through five indicators each, covering provider selection, information transparency, competition, procurement-time efficiency, and regulatory compliance. Provider performance was measured through work quality, schedule performance, cost efficiency, administration and management, and safety and compliance. Low-performing items were removed after corrected item-total correlation and reliability screening. The final construct reliability coefficients ranged from 0.708 to 0.943, meeting or exceeding the commonly applied 0.70 criterion [11].

Table 2. Final measurement structure and internal consistency

Construct	Retained Measurement Focus	Final Cronbach's Alpha
Open tendering (X1)	Selection process, competition, regulatory compliance	0.874
E-Catalog (X2)	Information transparency, provider competition, e-purchasing compliance	0.937
Work quality (Y1)	Specification conformity and rework control	0.910
Schedule performance (Y2)	On-time completion and delay control	0.934
Cost efficiency (Y3)	Budget conformity and change-cost control	0.943
Administration and management (Y4)	Reporting and coordination	0.708
Safety and compliance (Y5)	Construction safety and regulatory compliance	0.931

3.3. Data Analysis

Analysis proceeded through descriptive statistics, item validity, internal-consistency reliability, and multivariate assumption tests. Mardia's skewness and kurtosis tests were used to assess multivariate normality. Variance homogeneity was evaluated for each performance dimension, while Bartlett's test was used to confirm that the performance variables had sufficient intercorrelation for multivariate analysis. Because MANOVA is designed for correlated outcomes, a significant Bartlett result was interpreted as evidence supporting multivariate rather than separate independent analyses.

The simultaneous effects of X1 and X2 were tested using MANOVA. Pillai's Trace was selected as the principal criterion because it is comparatively robust when normality and variance-covariance assumptions are not fully satisfied [12-14]. Tests of Between-Subjects Effects were then used to evaluate each performance dimension at a significance level of 0.05. Results are reported using Pillai's V, F-statistics, and p-values.

IV. RESULT AND DISCUSSION

4.1. Descriptive Results and Instrument Quality

Respondents assessed the implementation of both procurement methods positively. The mean score for E-Catalog was 3.757, slightly higher than the open-tender mean of 3.705. Among the provider-performance dimensions, safety and compliance had the highest mean (4.024), followed by cost efficiency (3.857) and schedule performance (3.786). Administration and management had the lowest mean (3.262), indicating that reporting, coordination, and contract-management processes remain a relative improvement priority regardless of the procurement method.

Table 3. Descriptive statistics of procurement and performance constructs

Construct	Mean	Interpretation
Open tendering	3.705	Moderately high
E-Catalog	3.757	Moderately high
Work quality	3.444	Moderate
Schedule performance	3.786	Moderately high
Cost efficiency	3.857	Moderately high
Administration and management	3.262	Moderate
Safety and compliance	4.024	High

Item screening identified several indicators with corrected item-total correlations below the adopted threshold. After removing those indicators, the procurement constructs and all five performance scales achieved acceptable to very high internal consistency. The final reliability range of 0.708-0.943 supports the use of composite scores in the multivariate analysis. The screening step was particularly important for quality and schedule constructs, where one weak indicator in each scale reduced the initial reliability.

4.2. Multivariate Assumption Tests

Mardia's tests indicated deviations from multivariate normality for both skewness and kurtosis. Variance homogeneity was satisfied for quality, time, cost, and safety/compliance, but not for administration and management. Bartlett's test was significant, demonstrating that the five performance variables were intercorrelated and suitable for joint analysis. These findings supported the use of Pillai's Trace as the principal MANOVA statistic because of its relative robustness to limited assumption violations.

Table 4. Summary of multivariate assumption tests

Assessment	Statistic	p-value	Interpretation
Mardia skewness	65.054	0.002	Multivariate normality not satisfied
Mardia kurtosis	2.716	0.007	Multivariate normality not satisfied
Variance homogeneity: Y1, Y2, Y3, Y5	Chi-square = 0.134-2.967	0.227-0.935	Satisfied
Variance homogeneity: Y4	Chi-square = 7.255	0.0266	Not satisfied
Bartlett correlation test	Chi-square = 55.639	<0.001	Outcomes sufficiently correlated

4.3. Simultaneous Effects of Procurement Methods

The MANOVA results show that both procurement constructs significantly affected the combined provider-performance outcomes. Open tendering produced Pillai's V of 0.376 with F (5,35) = 4.125 and p = 0.004. E-Catalog produced Pillai's V of 0.421 with F (5,35) = 5.088 and p = 0.001. The larger Pillai value and F-statistic for E-Catalog indicate a relatively stronger multivariate association in the observed sample.

Table 5. Pillai's Trace MANOVA results

Effect	Pillai's Trace	F	df	p-value	Decision
Open tendering (X1)	0.376	4.125	5, 35	0.004	Significant
E-Catalog (X2)	0.421	5.088	5, 35	0.001	Significant

The findings support the view that procurement affects more than the administrative period before contract award. The method shapes competition, qualification, information availability, transaction speed, and the conditions under which the provider begins project delivery. This result is consistent with research showing that procurement systems influence project success through governance, integration, and incentive structures [2,3,15].

4.4. Effects on Individual Performance Dimensions

Open tendering significantly affected work quality, schedule performance, and cost efficiency. Its effects on administration and management and on safety/compliance were not significant. E-Catalog significantly affected four dimensions: work quality, schedule performance, cost efficiency, and safety/compliance. Administration and management were again not significant. Thus, the administrative-management dimension appears to be driven more by internal project governance, document control, communication, and owner-provider coordination than by procurement method alone.

Table 6. Tests of between-subjects effects

Method	Performance Dimension	F	p-value	Decision
Open tendering	Work quality	8.724	0.005	Significant
Open tendering	Schedule performance	11.962	0.001	Significant
Open tendering	Cost efficiency	7.655	0.009	Significant
Open tendering	Administration and management	0.958	0.334	Not significant
Open tendering	Safety and compliance	0.164	0.688	Not significant
E-Catalog	Work quality	12.844	<0.001	Significant
E-Catalog	Schedule performance	13.804	<0.001	Significant
E-Catalog	Cost efficiency	11.632	0.002	Significant
E-Catalog	Administration and management	3.225	0.080	Not significant
E-Catalog	Safety and compliance	6.532	0.015	Significant

The strongest univariate effect for both methods occurred in schedule performance. For open tendering, the result may reflect the contribution of formal evaluation, contractor qualification, and competitive pressure to implementation readiness. However, the procurement timetable itself must be started early enough to avoid shifting delays from the selection stage into construction. For E-Catalog, standardized information and a shorter purchasing sequence can support rapid award and mobilization, explaining its stronger schedule association.

E-Catalog also showed stronger F-statistics for quality and cost. This does not imply that electronic purchasing automatically guarantees superior technical outcomes. A more reasonable interpretation is that standardized specifications, visible prices, and a pre-listed provider environment can reduce information uncertainty for suitable work packages. These advantages depend on accurate catalog specifications, sufficient provider competition, inspection, testing, and contract enforcement. Where work is unique or technically complex, open tendering may still provide a more appropriate platform for detailed method evaluation.

Safety and compliance were significantly associated only with E-Catalog in the partial tests. This result may reflect the influence of standardized documentation and eligibility requirements, although the survey design cannot establish the precise causal mechanism. The finding should therefore be treated as evidence for further investigation rather than a basis for assuming that one method is inherently safer. Safety performance remains primarily dependent on project-specific leadership, planning, resources, and supervision [6].

4.5. Managerial Implications

The results support a contingent procurement strategy. Public agencies should avoid choosing a method solely because it is faster or more familiar. Selection should consider project complexity, specification maturity, urgency, market depth, technical risk, and the availability of reliable performance information. E-Catalog is most suitable when the work is standardized, the scope is stable, listed providers are sufficiently competitive, and early mobilization is important. Open tendering is more suitable when alternative technical methods must be compared, the work is complex or high-risk, or wider market competition is required.

Table 7. Procurement selection and control priorities

Project Condition	Preferred Approach	Required Controls
Standardized, repeatable, and time-sensitive road work	E-Catalog	Verify specifications and prices; check provider capacity; monitor delivery and field performance
Complex, high-value, or non-standard work	Open tendering	Use balanced technical-price evaluation; verify methodology, resources, and risk controls
Limited competition in the catalog or tender market	Market assessment before selection	Expand supplier outreach, review packaging, and prevent concentration
Weak administration and coordination performance	Either method with governance strengthening	Shared document system, response deadlines, KPI monitoring, and post-project evaluation

A provider-performance database should integrate project quality, time, cost, administration, safety, claims, and completion records. Such a database can improve future qualification, catalog evaluation, and risk-based method selection. Post-award management should use common key performance indicators, periodic coordination meetings, digital document control, and corrective-action deadlines. These measures address the study's lowest-rated dimension—administration and management—which was not significantly explained by either procurement method.

V. CONCLUSION

This study examined the effects of open tendering and E-Catalog procurement on five dimensions of road construction service provider performance in East Kalimantan. Based on 42 valid responses, both methods had significant multivariate effects. Open tendering produced Pillai's $V = 0.376$ ($p = 0.004$), while E-Catalog produced the stronger effect, $V = 0.421$ ($p = 0.001$).

Open tendering significantly affected quality, time, and cost. E-Catalog significantly affected quality, time, cost, and safety/compliance. Neither method significantly affected administration and management, indicating that document control, communication, coordination, and contract governance require direct managerial intervention beyond the procurement mechanism. The results do not support a single method for every project. E-Catalog is recommended for standardized and urgent work with adequate catalog competition; open tendering remains appropriate for complex, high-risk, and technically differentiated projects.

The study is limited by purposive sampling, a relatively small provincial dataset, perception-based measures, and incomplete multivariate normality. Future research should compare objective project records across procurement groups, including procurement lead time, planned and actual duration, cost deviation, rework, safety incidents, claims, and provider concentration. Larger multi-province studies and matched-project designs would strengthen causal interpretation and provide a more robust decision model for public construction procurement.

REFERENCES

[1]. Wibowo, A., Siregar, R., & Rahman, D. (2022). The role of the construction industry in Indonesia's economic growth. *IOP Conference Series: Earth and Environmental Science*, **1061**: pp. 012028. https://doi.org/10.1088/1755-1315/1061/1/012028

[2]. Tang, Z. W., Ng, S. T., & Skitmore, M. (2019). Influence of procurement systems to the success of sustainable buildings. *Journal of Cleaner Production*, **218**: pp. 1007-1030. https://doi.org/10.1016/j.jclepro.2019.01.213

[3]. Laryea, S., & Watermeyer, R. (2024). Using construction procurement strategy to achieve socioeconomic development objectives. *Heliyon*. https://doi.org/10.1016/j.heliyon.2024.e34550

[4]. Al Fath, A. A., et al. (2024). Readiness for implemented sustainable procurement in Indonesian government construction projects. *Buildings*, **14**(*5*): pp. 1424. https://doi.org/10.3390/buildings14051424

[5]. Ling, F. Y. Y., & Tran, H. (2012). Performance evaluation of design-build contractors in Singapore. *Engineering, Construction and Architectural Management*, **19**(*6*): pp. 666-684. https://doi.org/10.1108/09699981211277571

[6]. Zou, P., & Sunindijo, R. Y. (2021). Integrating human and organizational factors into construction performance measurement. *Journal of Management in Engineering*, **37**(*5*): pp. 1-12. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000921

[7]. Naji, K. K., Gunduz, M., & Falamarzi, M. H. (2022). Assessment of construction project contractor selection success factors considering their interconnections. *KSCE Journal of Civil Engineering*. https://doi.org/10.1007/s12205-022-1377-6
[8]. Rahim, F., & Yuliana, D. (2022). Digital transformation in public procurement: A case of Indonesia's e-procurement system. *Public Administration and Policy*, **25**(*3*): pp. 155-169. https://doi.org/10.1108/PAP-05-2022-0034
[9]. Love, P. E. D., Ahiaga-Dagbui, D. D., & Irani, Z. (2022). Revisiting cost and time performance in construction: A systemic review. *Automation in Construction*, **142**: pp. 104480. https://doi.org/10.1016/j.autcon.2022.104480
[10]. Nguyen, T. H., & Zhang, G. (2020). Quality performance measurement in construction projects: A review of practices and challenges. Engineering, *Construction and Architectural Management*, **27**(*9*): pp. 2529-2547. https://doi.org/10.1108/ECAM-11-2019-0637
[11]. Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, **16**(*3*): pp. 297-334. https://doi.org/10.1007/BF02310555
[12]. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis (8th ed.)*. Cengage Learning. https://www.cengage.uk/c/multivariate-data-analysis-8e-hair-babin-anderson-black/9781473756540/?searchIsbn=9781473756540
[13]. Field, A. (2018). *Discovering statistics using IBM SPSS Statistics (5th ed.)*. Newbury Park: Sage Publications.
[14]. Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics (7th ed.)*. Pearson.
[15]. Osei-Tutu, E., Adjei-Kumi, T., & Kissi, E. (2022). Procurement methods and contractor performance in public construction projects. *Built Environment Project and Asset Management*, **12**(*3*): pp. 421-437. https://doi.org/10.1108/BEPAM-09-2021-0149
[16]. Mahamid, I. (2021). Performance measurement framework for public construction contractors. *Journal of Construction Engineering and Management*, **147**(*6*): pp. 04021061. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002061