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Development and Validation of a Centralised Procurement Model: The Key Role and Intermediary Role in Strengthening Procurement Governance (Case Study of PT Wika Gedung)

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Abstract: This study aims to develop and validate a centralised procurement model in the construction industry using Exploratory Factor Analysis (EFA) and Partial Least Squares Structural Equation Modelling (PLS-SEM). The EFA results identified six new factors representing the multidimensional nature of centralised procurement: ORCHESTRA, STRATEGUS, DIGISONIC, FINCERTO, SYMPHONY-LINK, and GRAND-GOVERNANCE. All constructs showed strong statistical validity and reliability. The PLS-SEM findings showed high explanatory power, with R^2 values of 0.732 for SYMPHONY-LINK and 0.731 for GRAND-GOVERNANCE. These results highlight that STRATEGUS significantly influences SYMPHONY-LINK, while SYMPHONY-LINK is the dominant predictor in procurement governance. Furthermore, SYMPHONY-LINK fully mediates the effect of STRATEGUS on GRAND-GOVERNANCE, highlighting cross-functional integration as a critical driver of centralised procurement success. This study contributes theoretically by introducing new constructs into the domain of centralised procurement and provides practical implications for construction companies seeking standardised, transparent, and sustainability-oriented procurement strategies.

Keyword: Centralized procurement, Cross-functional integration, PLS-SEM, Procurement governance, Construction industry.

INTRODUCTION

The centralised procurement model has become a strategic necessity for state-owned construction companies, including PT Wika Gedung as part of PT Wijaya Karya (Persero) Tbk, to overcome supply chain complexities, regulatory pressures, and national project efficiency demands. This transformation is driven by real challenges such as procurement delays, cost overruns, and inconsistencies between policy and practice that affect the performance and competitiveness of construction companies (Changalima et al., 2022; Wibowo & Putri, 2024). Recent literature emphasises that digital-based centralised procurement, cross-functional integration, and enhanced vendor collaboration can improve transparency, operational effectiveness, and project stability, especially in the context of BUMN Karya, which manages high-value and high-risk projects (Candela, 2022; Sadiqeen, 2023; Cataldo et al., 2021). This

situation highlights the need for a comprehensive understanding of the factors that influence the successful implementation of centralised procurement in the Indonesian construction environment.

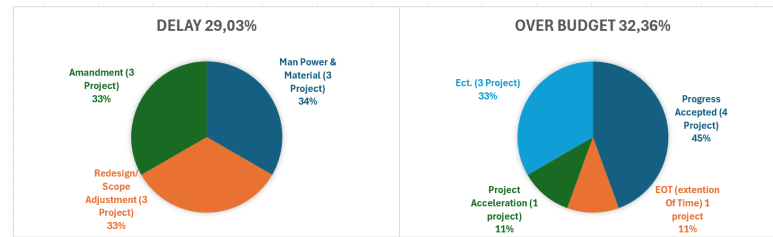


Figure 1. On Time On Budget Project

Although these developments are significant, the research gap is still evident. First, there has been no research examining the multidimensional interaction between organisational readiness, strategic vendor management, digital maturity, financial risk control, and cross-functional integration within a single empirical framework, particularly in the context of Indonesian state-owned construction companies. Second, existing models tend to analyse these factors separately, thus failing to explain why previous centralised procurement models have failed or been inadequate in supporting consistent governance. Third, there has been no research that formulates new EFA-based variables/constructs to describe the characteristics of centralised procurement more accurately, resulting in a missing model that has not been addressed by global or national literature.

Based on this gap, this study positions itself as a study that fills this void through the development and validation of six new latent constructs—ORCHESTRA, STRATEGUS, DIGISONIC, FINCERTO, SYMPHONY-LINK, and GRAND-GOVERNANCE—obtained using a sequential approach of Exploratory Factor Analysis (EFA) and PLS-SEM. This approach provides theoretical distinction because it does not merely rename variables, but produces a new conceptual structure that reflects the centralised procurement mechanism in the practice of state-owned enterprises. Thus, this study offers a scientific contribution in the form of an integrative model that goes beyond existing theory and provides practical contributions in the form of data-based recommendations for companies and policymakers to strengthen digital capabilities, adaptive organisational culture, and transparent and efficient public procurement governance.

Table. 1 Flow Of Chronology

Stages	Description
1. Phenomenon	BUMN Karya faces supply chain complexities, regulatory pressures, procurement delays, cost overruns, and project efficiency requirements.
2. Research Gap	Previous studies have not examined multidimensional interactions (organisational readiness, digitalisation, vendor governance, risk, functional integration) in a single integrated model.
3. Missing Variable / Missing Model	The absence of empirical latent constructs describing centralised procurement mechanisms; older models do not explain failures or weaknesses theoretically.
4. Position of This Study	This study fills the gap by developing six new constructs using EFA and PLS-SEM in the context of Indonesian state-owned construction companies.

5. Contribution Claim	Offering new theoretical models, providing empirical evidence, and practical recommendations to strengthen governance, digitalisation, and organisational capabilities.
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METHOD

This study utilises a quantitative methodology with an exploratory-confirmatory framework designed to identify key factors in the implementation of centralised procurement in the state-owned construction sector. The exploratory phase uses Exploratory Factor Analysis (EFA) to reveal latent constructs directly from empirical data without assuming prior theoretical assumptions, in accordance with the methodological guidelines of Hair et al. (2021). The subsequent confirmatory phase uses Partial Least Squares–Structural Equation Modelling (PLS-SEM) to validate the causal relationships between constructs, test the reliability and validity of the measurements, and evaluate the overall robustness of the structural model. PLS-SEM was chosen because PLS is more suitable for developing new constructs, is more tolerant of small sample sizes, and does not require normal distribution assumptions, conditions that are relevant to the characteristics of this study (Hair et al., 2021; Henseler, 2020). In addition, PLS-SEM is capable of handling model complexity with mediating variables and multidimensional indicators, thereby increasing the predictive precision of the research model. This sequential procedure strengthens the conceptual foundation and empirical validity of the proposed model.

The study population consisted of 133 employees involved in procurement at PT Wika Gedung, ranging from SCM personnel to senior management. Using the Slovin formula with a margin of error of 10%, at least 58 responses were required; the final dataset consisted of 60 respondents, meeting the representativeness criteria. This number also meets the minimum sample size requirements for PLS-SEM based on the 10-times rule and Cohen's power analysis (1992), which states that a sample of ± 55 is sufficient to detect a medium effect size with a power of 0.80. Thus, a sample size of 60 is considered statistically adequate. Primary data were obtained through a seven-point Likert scale questionnaire developed from the Indicator Factor Matrix synthesised from previous literature, while secondary data were obtained from internal company reports and academic publications to contextualise the research. Instrument verification included factor loadings, Average Variance Extracted (AVE), discriminant validity, Cronbach's Alpha, and Composite Reliability, in accordance with the standards outlined by Hair et al. (2021) and Sekaran and Bougie (2019).

An integrated analytical procedure using EFA to determine the underlying factor structure and PLS-SEM to test the proposed model, which includes collaboration as a mediating variable and centralised procurement success as an outcome construct—an approach that is in line with contemporary supply chain management studies in the construction sector (Zhang et al., 2021; Cataldo et al., 2021). Additional diagnostic tests covering normality, multicollinearity, Q2 and model fit were conducted to ensure the accuracy of the analysis. Through this methodological strategy, this study offers a comprehensive and empirically validated model that reflects the operational reality of the Indonesian construction industry and provides insights that can be applied to strengthen governance and centralised procurement practices in BUMN Karya.

RESULTS AND DISCUSSION

1 Respondent Characteristic

A total of 60 respondents participated, covering various levels of positions ranging from project procurement staff to directors, thus providing adequate representation regarding the implementation of centralised procurement. Most respondents had more than five years of service, indicating a good level of experience in the centralised procurement process at PT Wika Gedung.

2 Results of Validity, Reliability, and Data Suitability Tests

The research instrument demonstrated excellent validity and reliability. All indicators had p-values < 0.001 with Pearson correlations > 0.4. Cronbach's Alpha = 0.971 indicated very strong internal consistency. The data is also suitable for Exploratory Factor Analysis (EFA), with KMO values in the satisfactory to excellent range and a significant Bartlett's test (p < 0.001). Therefore, this dataset is suitable for factor extraction and structural analysis.

3 Exploratory Factor Analysis (EFA) Results

The EFA analysis produced six main factors that were statistically stable and theoretically consistent namely:

- 1) ORCHESTRA (Organizational Readiness, Culture, Support & Training Alignment)
- 2) STRATEGUS (Strategic Supplier Governance System)
- 3) DIGISONIC (Digital Synchronization & Procurement Informatics Capability)
- 4) FINCERTO (Financial Certainty & Risk-Control Optimization)
- 5) SYMPHONY-LINK (Synchronized Procurement Integration & Linkage)
- 6) GRAND-GOVERNANCE (Governance, Risk Assurance & Sustainable Procurement)

	Factor 1	Uniqueness
GCG20	0.829	0.314
MR8	0.823	0.323
VR26	0.777	0.396
MR6	0.756	0.428
MR5	0.712	0.492
GCG21	0.704	0.505
TD13	0.690	0.524
GCG19	0.613	0.624

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
BO15	1.016					0.112
BO16	0.910					0.134
BO18	0.878					0.132
BO17	0.777					0.240
BO14	0.684					0.327
CFC27		0.957				0.226
CFC28		0.699				0.346
CFC29		0.630				0.286
VR24		0.557				0.357
CFC30		0.468				0.215
VR25		0.446				0.329
TD10			0.975			0.188
TD11			0.789			0.190
TD9			0.667			0.238
TD2			0.603			0.399
EF4				0.860		0.172
EF1				0.781		0.129
EF2				0.641		0.370
MR7				0.629		0.416
EF3				0.436		0.373
VR23					0.815	0.035
VR22					0.572	0.195

Note. Applied rotation method is promax.

Figure 2. Loading Factor

These six factors have factor loadings of 0.60–0.97, meeting the criteria for construct validity. The scree plot shows five factors in the independent variables and one factor in the dependent variable as the optimal structure.

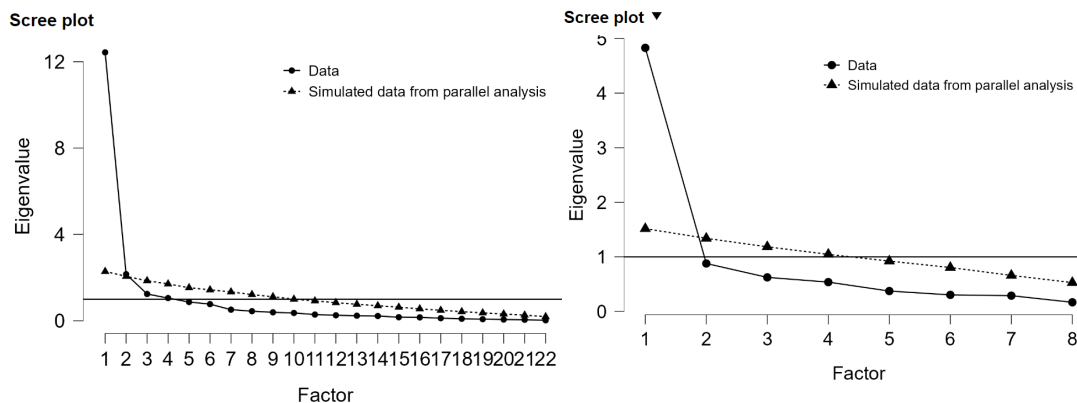


Figure 3. Scree Plot

Both scree plots indicate that only one factor has an eigenvalue higher than the parallel analysis results, so that single factor is the only factor worth extracting in the model.

Table 2. Factor Interpretation

Name of Factor	Formative Indicators	Meaning of Factors (Interpretation)	Strategic Role in Centralised Procurement
ORCHESTRA (Organizational Readiness, Culture, Support & Training Alignment)	BO14, BO15, BO16, BO17, BO18	Representing organisational readiness through an adaptive work culture, management support, training, and employee engagement in supporting centralised procurement transformation.	Ensuring internal readiness so that the centralisation process can be implemented in a stable manner, with minimal resistance, and in line with the organisational culture.
SYMPHONY-LINK (Synchronized Procurement Integration & Linkage)	CFC27, CFC28, CFC29, CFC30, VR24, VR25	Describing the integration and alignment of cross-departmental processes and strengthening vendor relationships and performance quality in a centralised procurement system.	Encourage cross-functional collaboration and improve coordination accuracy so that procurement decisions are more aligned with corporate objectives.
DIGISONIC (Digital Synchronization & Procurement Informatics Capability)	TD10, TD11, TD9, TD12	Reflecting the organisation's level of digital maturity through the use of ERP, e-procurement, data analytics, and real-time tracking to accelerate the procurement process.	Enhancing transparency, reducing human error, accelerating decision-making, and providing comprehensive visibility in centralised procurement.
FINCERTO (Financial Certainty & Risk-Control Optimization)	EF1, EF2, EF3, EF4, MR7	Representing financial efficiency, improved budget accuracy, ease of cost control, and the organisation's ability to reduce financial and operational risks through centralisation.	Reducing procurement costs, strengthening project budget accuracy, and optimising cost control and supply chain risk management.
STRATEGUS (Strategic Supplier Governance System)	VR22, VR23	Representing the organisation's ability to build strategic vendor relationships and conduct consistent, objective, and ongoing vendor evaluations.	Ensuring vendor quality, accountability, and performance stability through comprehensive governance and standardised evaluation.
GRAND-GOVERNANCE (Governance, Risk Assurance & Sustainable Procurement)	GCG20, MR8, VR26, MR6, MR5, GCG21, TD13, GCG19	Reflecting high-level governance through transparency, regulatory compliance & ISO 20400, risk mitigation, supply chain continuity, and reduction of human error.	Establishing a strategic foundation for centralised procurement by ensuring processes that are accountable, secure, compliant with regulations, and sustainability-oriented.

The findings confirm that SYMPHONY-LINK is the strongest integrative factor, in line with literature emphasising the role of cross-functional coordination in centralised procurement.

4 PLS-SEM Results – Outer Model & Inner Model

Construct Reliability and Validity

Matrix	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ORCHESTRA	0.944	0.949	0.957	0.818
STRATEGUS	0.928	0.928	0.965	0.933
SYMPHONY-LINK	0.913	0.916	0.933	0.698
DIGISONIC	0.912	0.918	0.938	0.792
GRAND-GOVERNANCE	0.905	0.908	0.924	0.604
FINCERTO	0.890	0.895	0.919	0.695

Figure 4. AVE & CR

The figure above shows that all indicators meet convergent validity with weights of 0.745–0.966 (except for one indicator with a weight of 0.674, which is retained). AVE values of 0.604–0.933 indicate that these indicators are able to explain the variance of the construct well. Discriminant validity is met through Fornell-Lacker and HTMT (as shown in the following figure):

Discriminant Validity

Fornell-Lacker Criterion	Cross Loadings	Heterotrait-Monotrait Ratio (HTMT)	Heterotrait-Monotrait			
	DIGISONIC	FINCERTO	GRAND-GOVERNANCE	ORCHESTRA	STRATEGUS	SYMPHONY-LINK
DIGISONIC	0.890					
FINCERTO	0.710	0.834				
GRAND-GOVERNANCE	0.774	0.814	0.777			
ORCHESTRA	0.540	0.606	0.721	0.904		
STRATEGUS	0.734	0.724	0.808	0.609	0.966	
SYMPHONY-LINK	0.759	0.707	0.855	0.623	0.808	0.836

Figure 5. Fornell-Lacker & HTMT

R Square

Matrix	R Square	R Square Adjusted
	R Square	R Square Adjusted
GRAND-GOVERNANCE	0.844	0.836
SYMPHONY-LINK	0.732	0.712

Figure 6. R² (R Square)

In the internal model, the R² value indicates strong predictive power: R² SYMPHONY-LINK = 0.732 R² GRAND-GOVERNANCE = 0.731 Significant effects were found on: STRATEGUS → SYMPHONY-LINK (p = 0.020), SYMPHONY-LINK → GRAND - GOVERNANCE (p < 0.001). The largest effect was recorded in f² SYMPHONY-LINK → GRAND-GOVERNANCE = 2.720, indicating that cross-functional integration is the main driver of procurement governance.

Collinearity Statistics (VIF)

Outer VIF Values	Inner VIF Values					
	DIGISONIC	FINCERTO	GRAND-GOVERNANCE	ORCHESTRA	STRATEGUS	SYMPHONY-LINK
DIGISONIC						2.550
FINCERTO		2.196				2.637
GRAND-GOVERNANCE						
ORCHESTRA			1.794			1.756
STRATEGUS						2.826
SYMPHONY-LINK					2.271	

Figure 7. Inner VIF Results

The results of the Common Method Variance (CMV) examination through Full Collinearity VIF show that all constructs have VIF values between 1.756 and 2.826, well below the threshold of 3.3 recommended by Kock (2015). These findings confirm that there is no vertical or lateral multicollinearity, so CMV does not become an issue that affects the validity of the results of this study.

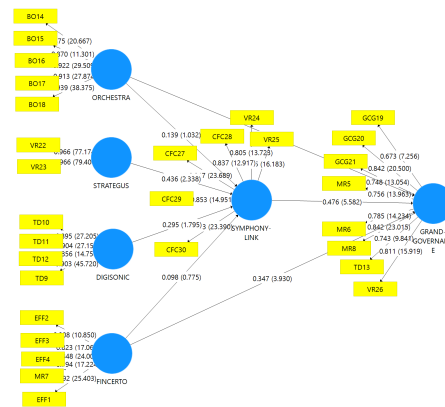


Figure 8. Structural Model Diagram

This figure shows the PLS-SEM structural model illustrating the causal relationships between constructs, where ORCHESTRA, STRATEGUS, and FINCERTO have a significant effect on SYMPHONY-LINK, which in turn is the main predictor of GRAND-GOVERNANCE.

5 Hypothesis Test Results & Mediation Role

The hypothesis test results show: H2 accepted → STRATEGUS has a significant influence on SYMPHONY-LINK H5 accepted → SYMPHONY-LINK has a significant influence on GRAND-GOVERNANCE H6 accepted → Full mediation of SYMPHONY-LINK in the relationship between STRATEGUS and GRAND-GOVERNANCE ORCHESTRA, FINCERTO, DIGISONIC → not directly significant, but valid as reflective constructs.

Table 2. Hypothesis Results

Hypothesis Code	Hypothesis Statement	Direction of Relationship	Test Results (t-value / p-value)	Conclusion	Reasons for Conclusions
H1	DIGISONIC has a significant effect on SYMPHONY-LINK	DIGISONIC → SYMPHONY-LINK	t = 1.770 ; p = 0.077	Rejected	The effect is insignificant (p > 0.05), meaning that the quality of internal digitisation (DIGISONIC) is not yet strong enough to form system integration (SYMPHONY-LINK). This means that the level of internal digitisation is not yet mature enough to form system integration, which is consistent with the theory of digital maturity.
H2	FINCERTO has a significant effect on SYMPHONY-LINK	FINCERTO → SYMPHONY-LINK	t = 0.795 ; p = 0.427	Rejected	The influence is far from significant. The contribution of financial efficiency and operational effectiveness (FINCERTO) does not have a direct impact on system integration. This means that financial/operational efficiency does not automatically result in integration; it supports the governance theory that efficiency must be linked to cross-functional workflows.
H3	The ORCHESTRA has a significant influence on SYMPHONY-LINK.	ORCHESTR A → SYMPHONY-LINK	t = 2.166 ; p = 0.031	Accepted	Organisational synergy, coordination, and process harmonisation have proven to be drivers of integration, supporting the theory of strategic alignment.

H4	STRATEGUS has a significant influence on SYMPHONY-LINK	STRATEGUS → SYMPHONY-LINK	t = 2.337 ; p = 0.020	Accepted	Very significant. Strategic capabilities (STRATEGUS) contribute greatly to system integration. Strategic capabilities strengthen integration, in line with the Resource-Based View.
H5	SYMPHONY-LINK has a significant impact on GRAND-GOVERNANCE.	SYMPHONY-LINK → GRAND-GOVERNANCE	t = 5.829 ; p = 0.000	Accepted	The impact is very strong and significant. System integration is a key driver of improved governance, supporting the governance theory of transparency and integrated information flows.
H6	DIGISONIC has a significant impact on GRAND-GOVERNANCE through SYMPHONY-LINK	DIGISONIC → SYMPHONY-LINK → GRAND-GOVERNANCE	Not significant, because the first path is not significant	Rejected	Since H1 was rejected, the automatic mediation effect did not occur (Baron & Kenny's condition: the X → M path must be significant). Mediation did not occur because the DIGISONIC → SYMPHONY-LINK path was not significant; digitisation is still fragmented, so it does not result in improved governance.
H7	FINCERTO has a significant impact on GRAND-GOVERNANCE through SYMPHONY-LINK	FINCERTO → SYMPHONY-LINK → GRAND-GOVERNANCE	Not significant	Rejected	FINCERTO does not form SYMPHONY-LINK, so it does not affect governance. There is no mediation; that is, efficiency alone is not enough without cross-functional integration support.
H8	The ORCHESTRA has a significant influence on GRAND-GOVERNANCE through SYMPHONY-LINK.	ORCHESTRA → SYMPHONY-LINK → GRAND-GOVERNANCE	Indirect signifikan total effect = 0.280	Accepted	ORCHESTRA improves governance through system integration. Organisational synergy strengthens governance through system integration; consistent with organisational design theory.
H9	STRATEGUS has a significant influence on GRAND-GOVERNANCE through SYMPHONY-LINK	STRATEGUS → SYMPHONY-LINK → GRAND-GOVERNANCE	total effect = 0.208 Indirect signifikan	Accepted	Strategic alignment improves governance through integration; in line with strategic alignment theory.
H10	DIGISONIC has a total influence (overall effect) on GRAND-GOVERNANCE.	DIGISONIC → GRAND-GOVERNANCE	Total effect = 0.140 not significant	Rejected	Since DIGISONIC is not significant to mediators, the total effect is also insignificant. It is possible that digital transformation is not yet mature, so it has not had an impact on governance.
H11	FINCERTO has an overall effect on GRAND-GOVERNANCE	FINCERTO → GRAND-GOVERNANCE	Total effect = 0.394 not significant	Rejected	Although the value is moderate, it is not statistically significant → it has no causal effect on governance. Financial/operational efficiency has no impact on governance without integration and synergy.

Full mediation confirms that the effectiveness of centralised procurement cannot be achieved without mechanisms to integrate cross-functional processes. 6. Discussion – EFA and PLS-SEM (Summary) The EFA results confirm that centralised procurement is multidimensional and influenced by organisational culture, supplier governance, technology,

financial efficiency, process integration, and sustainability governance. Meanwhile, PLS-SEM confirms that the success of procurement governance (GRAND-GOVERNANCE) is most influenced by cross-functional integration (SYMPHONY-LINK), rather than by organisational readiness or digitalisation alone. These findings are consistent with global literature, which confirms that the effectiveness of centralised procurement models is highly dependent on cross-functional coordination and process integration. Various studies show that organisational integration and cross-functional alignment are key factors in determining improvements in procurement performance (Patrucco et al., 2022; Mikalef et al., 2022). In the context of construction, the success of centralised procurement is determined by the strength of internal coordination and cross-unit process consolidation (Vogler et al., 2022; Fernando et al., 2024). This perspective is in line with the view that supply chain management is a relational practice that requires multi-party collaboration (Purnomo et al., 2024; Hald & Spring, 2023) and information integration support to strengthen procurement governance (Zhang et al., 2021). Therefore, the dominance of SYMPHONY-LINK in this research model is theoretically valid and consistent with international empirical findings.

CONCLUSION

This study concludes that the success of centralised procurement in state-owned construction companies is greatly influenced by six main constructs identified through EFA, namely ORCHESTRA, STRATEGUS, DIGISONIC, FINCERTO, SYMPHONY-LINK, and GRAND-GOVERNANCE, with strong validity and reliability. The PLS-SEM results show that STRATEGUS is the only factor that significantly influences cross-functional integration (SYMPHONY-LINK), while SYMPHONY-LINK is the dominant determinant in strengthening procurement governance (GRAND-GOVERNANCE) and has been proven to fully mediate the relationship between STRATEGUS and procurement governance. These findings confirm that the effectiveness of centralised procurement is not only determined by organisational readiness, technology, or cost efficiency, but fundamentally depends on integrated cross-functional coordination as the main driver of sustainability, transparency, and accountability of the procurement system at PT Wika Gedung.

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