# An Analysis of Critical Success Factors for Enhancing the Performance of Regional Apparatus Organizations (RAOs) in Construction Sector Development in Indonesia

**Siti Nurrusiah Smith**
Department of Civil Engineering, Universitas Hasanuddin, Gowa, Indonesia
Undung.smith@gmail.com

**Muhammad Isran Ramli**
Department of Civil Engineering, Universitas Hasanuddin, Gowa, Indonesia
isranramli@unhas.ac.id

**Syarif Burhanuddin**
Department of Civil Engineering, Universitas Hasanuddin, Gowa, Indonesia
syarifbur9@gmail.com

**Rosmariani Arifuddin**
Department of Civil Engineering, Universitas Hasanuddin, Gowa, Indonesia
rosmarianiarifuddin@unhas.ac.id (corresponding author)

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## ABSTRACT

**Regional Apparatus Organizations (RAOs) in every administrative region of Indonesia serve as the primary supervisory authorities, ensuring that government-managed construction infrastructure projects run efficiently and comply with applicable regulations. Nevertheless, their performance in several areas remains suboptimal due to weak risk management, limited human resource capacity, and low utilization of information technology. The current research specifically examined the Critical Success Factors (CSFs) that shape RAO performance in the construction sector and modeled the causal relationships among these factors. Data were collected through a literature review and a perception-based questionnaire survey involving 60 RAOs across Sulawesi Island. Analysis using Structural Equation Modeling (SEM) via SmartPLS software revealed that Supervision (X3) exerted the strongest influence (0.6749), followed by Institutional Capacity (X1) (0.1983) and Development/Guidance (X2) (0.1571). The CSFs-based model provides actionable references and enables RAOs to overcome operational barriers and supports local governments in strengthening institutional capacity and the supervision of construction projects. Furthermore, the findings highlight concrete strategies for policymakers to design targeted capacity-building initiatives, sustainable development programs, and improved supervision systems within the construction sector.**

***Keywords-Critical Success Factors (CSFs); Regional Apparatus Organizations (RAOs); Structural Equation Modeling (SEM)***

## I. INTRODUCTION

In Indonesia, the construction sector plays a pivotal role in national development. Beyond its economic share, the sector drives physical infrastructure expansion that facilitates inter-regional connectivity, particularly linking underdeveloped and developed areas. Investments in transportation networks, energy facilities, and public utilities have been crucial in reducing logistical bottlenecks and enabling regional integration. Moreover, the availability of reliable infrastructure strengthens Indonesia's position in global markets by lowering transaction costs and enhancing trade competitiveness. However, the Indonesian construction sector still faces a variety of challenges. These include limited human resource capacity, weak coordination among stakeholders, non-compliance with regulations, and supervision constraints. These challenges frequently manifest in measurable project issues, such as delays in completion, budget overruns, and compromised construction quality [1], which directly impact sector performance. In this context, the role of RAO becomes crucial as the primary oversight authority for monitoring the implementation of construction projects during both the planning and execution stages.

Infrastructure projects managed by RAOs are designed not only to support regional economic growth but also to strengthen local connectivity, reduce logistical barriers, and enhance the delivery of construction-related public services in their respective regions. At the regional level in Indonesia, RAOs hold direct responsibility for executing infrastructure initiatives. However, monitoring reports from various provinces have shown that many RAO-managed construction projects still encounter issues such as delays, budget overruns, and recurring quality deficiencies. These recurring challenges underscore the need to analyze the specific organizational and managerial factors that shape project outcomes, particularly within the framework of public-sector construction governance.

RAOs carry a strategic mandate to guarantee that construction sector development, especially project implementation, complies with regulations, is executed efficiently, and generates tangible benefits for local communities. Despite this mandate, evidence shows that RAO performance continues to fall short in several regions. Research has identified limited risk management capacity, insufficient technical and managerial competencies among human resources, and inadequate adoption of digital tools for project oversight as the dominant factors behind these shortcomings [2]. The performance of RAOs across Indonesia demonstrates marked regional disparities. Western regions, including Java and Sumatra, generally benefit from robust institutional systems, higher availability of qualified technical staff, and greater fiscal capacity. Conversely, eastern regions, such as Sulawesi and Papua, are often constrained by limited professional expertise, restricted financial resources, and insufficient supervisory mechanisms. These uneven conditions underscore the urgency of identifying context-specific CSFs to enhance RAO effectiveness in addressing diverse regional challenges. Given the persistent disparities and challenges in RAO performance across Indonesian regions, this study underscores the urgency of identifying CSFs that have a direct impact on their capacity to manage construction projects. Within this research, CSFs are defined as fundamental managerial, technical, and institutional dimensions that determine the ability of RAOs to effectively supervise and deliver construction projects in their respective regions.

In the context of RAO, CSFs encompass core elements such as management skills, communication effectiveness, regulatory support, and stakeholder management [3]. Identifying and mapping these CSFs enables RAOs to strengthen oversight functions, enhance budget transparency, and mitigate recurring problems like project delays and cost overruns. Considering the dynamic changes in the construction sector, examining CSFs to enhance RAO performance is required. In addition, the integration of sustainability principles introduces a new challenge that must be addressed in project development. Within this framework, research on CSFs can generate targeted strategic recommendations for RAOs to design training initiatives that are more effective, efficient, and sustainable.

In project management literature, the concept of CSFs has long been used to identify the determinants of project success. Previous research has reported 23 CSFs categorized into four groups: top management support, project manager competencies, project team skills, and stakeholder management knowledge [4]. Among these, top management support was found to have the greatest impact on construction project performance in Qatar. Authors in [5] utilized project management techniques to model CSFs in large-scale construction projects. The results indicated that employing the appropriate CSFs can enhance client satisfaction, team satisfaction, and project stability. Furthermore, authors in [6] affirmed the importance of value management in sustainable construction projects, identifying factors such as stakeholder involvement and resource efficiency as primary CSFs. However, most of these studies have focused on private or national projects, while few have explored the application of CSFs within the context of RAO in the construction sector. Authors in [7] explored the impact of working environment factors, such as supervisor support, job safety, and physical conditions, on employee performance in construction firms. Although they focused on the private sector, their findings highlight the importance of internal organizational capacity, which is also a critical element in improving RAO performance in public-sector infrastructure projects. Authors in [8] investigated the use of alternative construction materials and emphasized that partial replacement with recycled aggregates can maintain acceptable concrete quality. This finding reinforces the role of RAOs in ensuring material quality, promoting sustainable practices, and making informed technical decisions—functions that align with institutional capacity and supervisory duties as key CSFs.

CSFs in building projects have been extensively examined, while limited attention has been given to their application in improving the performance of RAOs. Therefore, this study analyzes the CSFs that influence RAO performance in the development of the construction sector. The findings are intended to serve as a practical reference for RAOs in addressing operational challenges and strengthening their role in managing construction projects.

## II. MATERIALS AND METHODS

### A. *Regional Apparatus Organizations*

RAOs function as the executive arms of local governments (provincial and regency/city levels) and are directly accountable to regional heads for administering delegated governmental affairs. In Indonesia, RAOs are legally mandated through regional governance regulations that reflect the specific needs and administrative typologies of each province, regency, or city. Within infrastructure development, RAOs are not only responsible for formulating project plans and allocating budgets but also for supervising technical implementation during construction.

*1) Planning Stage*

At this stage, the involved RAOs include:

- Regional Development Planning Agency (BAPPEDA): responsible for formulating short-, medium-, and long-term development plans, including strategic construction programs.
- Regional Secretariat: through the Development Division, Economic Division, and Goods and Services Procurement Bureau (BPBJ), it facilitates policy coordination and procurement.
- Organization and Management Division as well as the Planning Division/Section in each technical RAO: formulates organizational structures and program evaluations.

*2) Budgeting Stage*

The budgeting function is carried out by:

- Regional Financial and Asset Management Agency (BPKAD): responsible for the planning, execution, and administration of regional finances.
- Regional Revenue Agency (BAPPENDA): ensures regional revenue as a funding source for development.
- Regional House of Representatives (DPRD) Secretariat: through its legislative function, reviews, analyzes, and approves the construction project budgets.

*3) Implementation Stage*

This stage is carried out by technical RAOs, including:

- Public Works and Spatial Planning Office (PUPR): serves as the executor of physical infrastructure development.
- Implementation Division/Sub-department within PUPR: prepares technical documents, conducts field supervision, and manages construction execution.
- Technical Centers/Work Units such as Road Maintenance Centers, Irrigation Centers, and Construction Materials Laboratories: support technical operations.

RAOs in the construction sector are typically overseen by the Public Works and Spatial Planning Agency (PUPR).

The performance of RAOs refers to the extent of their effectiveness and efficiency in carrying out their primary duties and functions to achieve the strategic goals of the regional government. This indicator reflects an organization's ability to deliver optimal public services by maximizing the utilization of available financial, human, and technical resources in a transparent and accountable manner. Performance can be analyzed through five key dimensions identified in [9]: (i) Productivity, measured by the extent to which outputs meet predetermined development targets; (ii) Service Quality, reflected in the ability to deliver services that satisfy public expectations; (iii) Responsiveness, indicated by the timeliness and accuracy in addressing community needs; (iv) Responsibility, shown by compliance with regulatory frameworks and administrative procedures; (v) Accountability, demonstrated through transparency in financial management and resource utilization.

*B. Research Methodology*

*1) Research Stages*

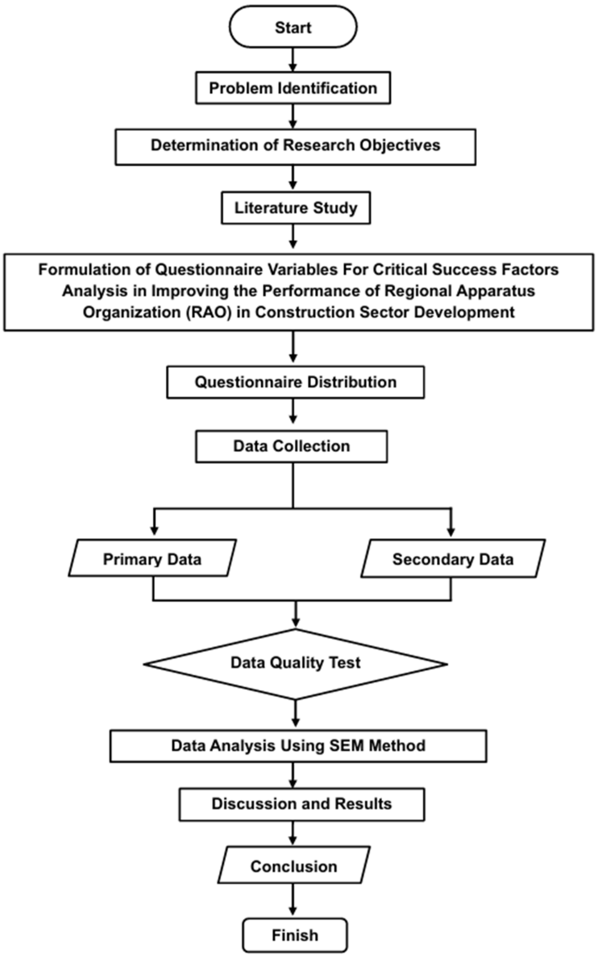


Fig. 1. Research stages.

*2) Research Strategy*

A quantitative approach was adopted to identify and validate CSFs influencing RAO performance in the construction sector, as emphasized in recent empirical studies on sustainable project delivery [10]. This encompasses the procedures for obtaining solutions to the research problem, the tools for data collection, and the methods for data processing within the research context. It is crucial to develop a strong research strategy, especially considering that available resources are typically limited in the pursuit of research objectives. There are five types of research strategies: case studies, experiments, surveys, historical research, and analysis [11]. When choosing a research strategy, three factors need to be considered: the type of research question being asked, the level of control the researcher has over the events or behaviors being studied, and the focus on ongoing events. In this study, the research questions were grouped following the categorization framework in [11], which links question types (what, how, why) with suitable methodological choices. This categorization guided the selection of case-survey design for subsequent research stages. The question grouping is arranged in Table I.

TABLE I. RESEARCH STRATEGY

| Research questions | Research strategy | Expected outcomes |
|---|---|---|
| RQ1: What? | Literature study | CSFs influencing the performance improvement of RAO in the construction sector development |
| RQ2: How? | Questionnaire survey, Data analysis using SEM | The level of CSFs implementation on the performance of RAO in the construction sector development |

*3) Data Collection*

The study adopted a sequential exploratory design. In the first phase, a literature review was conducted to identify theoretical constructs and CSF indicators. These informed the development of the survey instrument used in the second phase for quantitative validation through SEM [12]. This approach enabled a structured transition from concept identification to empirical validation, ensuring that the identified CSFs were tested within the specific context of RAO performance [13, 14].

*a) Data Collection Stage 1*

Qualitative data collection often includes interviews, observations, and a review of previous research, which allows researchers to understand the social and cultural context [15, 16]. Within this study, such interpretation was carried out through literature-based evidence rather than direct interviews or observations. The first stage applied a literature study focusing on previous empirical findings, academic publications, and official reports to extract theoretical constructs and CSF indicators relevant to RAO performance. This process was directed at identifying the CSFs that shape the effectiveness of RAO in construction sector development. The outcome of this stage specifically addressed Research Question 1 (RQ1).

*b) Data Collection Stage 2*

For the second stage of data collection, a quantitative approach was implemented through a structured questionnaire survey. This method was chosen because it enables the collection of standardized data from a relatively large number of RAOs, allowing for statistical testing of the relationships between identified CSFs and organizational performance. The survey design emphasized objectivity and reproducibility, ensuring that the results could be generalized within the scope of the study population. While this approach supports measurable and comparable findings, its limitations lie in the complexity of data analysis and reduced sensitivity to the broader social and institutional context [17].

Questionnaires were distributed to 60 RAOs in Sulawesi under the supervision of the Construction Services Development Board Region VI Makassar. The data collection instrument was developed based on indicators derived from the literature. Validity and reliability tests were conducted using SmartPLS to ensure the accuracy and consistency of the measurement model. This methodological choice was guided by prior recommendations [18], which emphasize aligning data collection instruments with the research context and the constructs being measured. This questionnaire survey addressed Research Question 2 (RQ2). The decision to select 60 respondents was justified both methodologically and contextually. Methodologically, the "10-times rule"suggests that the minimum sample size should be ten times the number of indicators in the most complex construct for SEM-PLS analysis [19], and the 60 responses met this criterion. Contextually, the study targeted all RAOs supervised by the Construction Services Development Board (Balai Jasa Konstruksi) Region VI Makassar, covering Sulawesi Island. Because the population consists of exactly 60 RAOs, the survey successfully achieved full coverage. The results from this questionnaire data collection aim to establish the relationship between these CSFs and the effectiveness of construction sector development implementation.

*4) Research Instruments*

The questionnaire for RQ2 was developed as a structured set of written questions to capture respondents' perceptions [20]. A five-point Likert scale was applied to quantify attitudes, opinions, and perceptions toward defined research variables, enabling systematic measurement and analysis within the study.

TABLE II. MEASUREMENT SCALES

| No | Description | Score |
|---|---|---|
| 1 | Very Unnecessary | 1 |
| 2 | Unnecessary | 2 |
| 3 | Neutral | 3 |
| 4 | Necessary | 4 |
| 5 | Very Necessary | 5 |

## III. RESULTS AND DISCUSSION

### A. *Results of Data Analysis for RQ1*

The results can be seen in Table III.

### B. *Results of Data Analysis for RQ2*

*1) Respondent Overview*

A total of 60 respondents completed the survey, all of whom met the predefined inclusion criteria. The collected data were then used for model analysis and interpretation. The respondent data include characteristics, such as institutional type, regional distribution, and functional role in RAO, which provide an essential context for interpreting the SEM-PLS analysis results. The results can be seen in Figures 2-5.

TABLE III. ANALYSIS OF CRITICAL SUCCESS FACTORS

| Variable | Sub-variable | | Indicator | References |
|---|---|---|---|---|
| X1 | Institutional capacity | X1.1 | Application of organizational structure. | [21, 22] |
| | | X1.2 | Availability of human resources. | [23, 24] |
| | | X1.3 | Availability of financial capacity. | [25, 26] |
| | | X1.4 | Utilization of information technology. | [27, 28] |
| X2 | Development/Guidance | X2.1 | Implementation of training and/or certification related to construction services. | [29, 30] |
| | | X2.2 | Implementation of technical guidance, workshops, refreshments, socialization, and/or seminars related to construction service. | [31] |
| X3 | Supervision | X3.1 | Enforcement of orderly construction business practices. | [32] |
| | | X3.2 | Enforcement of orderly construction service. | [33] |
| | | X3.3 | Enforcement of orderly utilization of construction services. | [34, 35] |
| | | X3.4 | Administration of construction service information system data (SIPJAKI – SIJK). | [36] |
| | | X3.5 | Availability of regulations (Government/ Regional) | [37] |

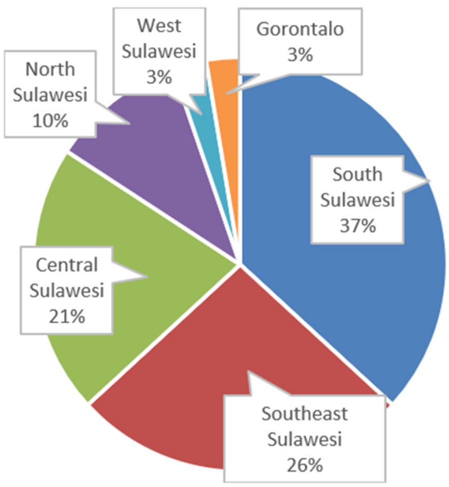


Fig. 2. Respondent agencies.

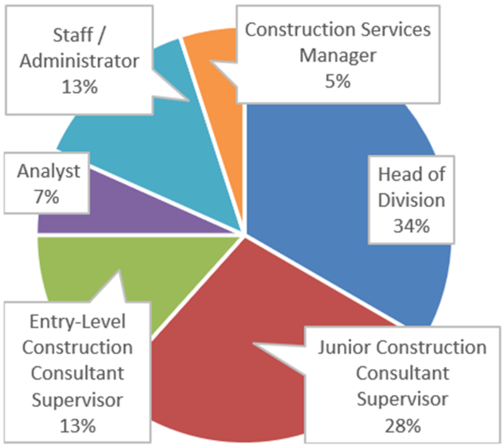


Fig. 3. Respondent positions.

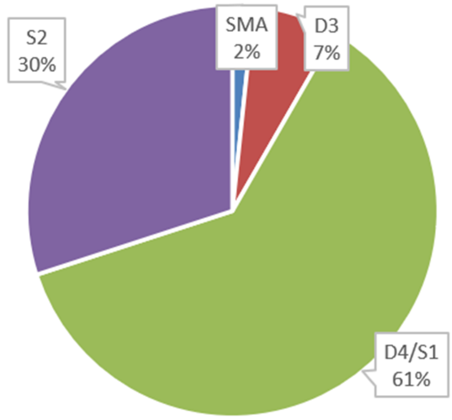


Fig. 4. Respondent education.

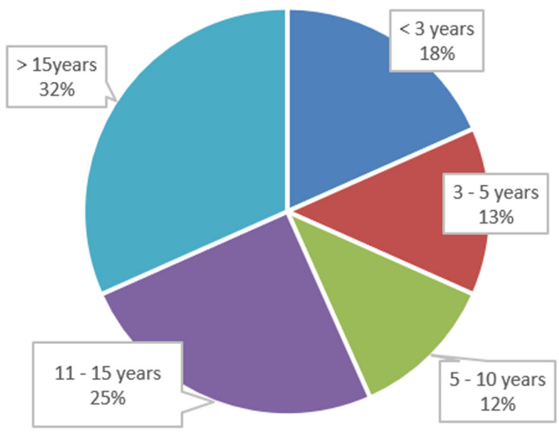


Fig. 5. Respondent work experience.

*2) Data Analysis*

The produced outer model can be seen in Figure 6.

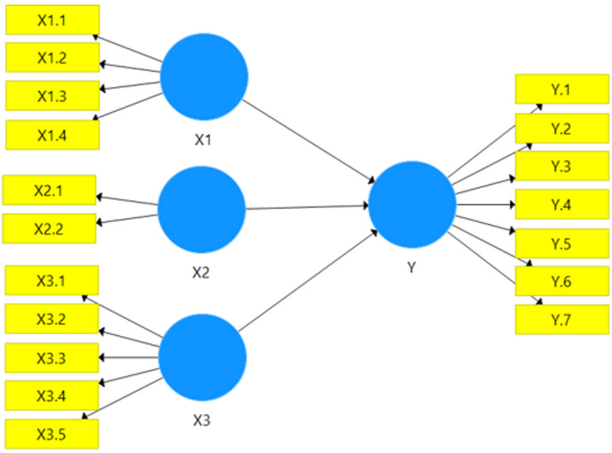


Fig. 6. Outer model.

*a) Indicator Reliability*

In the context of SmartPLS analysis for this study, indicator reliability was assessed based on outer loading thresholds. Indicators below 0.40 were removed, while those ranging between 0.40–0.70 were retained only if reliability and convergent validity tests confirmed adequacy. Outliers were addressed through indicator removal where necessary. The results of the validity and reliability tests are displayed in Table IV.

TABLE IV. OUTER MODEL RESULTS

| | $\rho_A$ | Cronbach's alpha | Composite reliability | AVE value |
|---|---|---|---|---|
| X1 | 0.8806 | 0.8271 | 0.8856 | 0.6654 |
| X2 | 0.7987 | 0.7830 | 0.9015 | 0.8207 |
| X3 | 0.8800 | 0.8581 | 0.9025 | 0.6572 |
| Y | 0.9190 | 0.9107 | 0.9292 | 0.6536 |

*b) Calculating Validity and Reliability*

- Internal Consistency Reliability

The common criteria used to measure internal consistency reliability are Cronbach's alpha (α) and Composite Reliability (CR). These are defined as the instrument's ability to consistently measure its indicators. The calculated reliability values for both should be ≥ 0.70.

- Convergent Validity

In this study, convergent validity was evaluated by examining whether a measure positively correlated with alternative measures of the same construct. At the construct level, the criterion applied was the Average Variance Extracted (AVE), calculated as the average squared loadings of the indicators associated with each construct. An AVE value >0.50 was considered evidence of adequate convergent validity [38].

- Discriminant Validity

Discriminant validity assesses the extent to which a construct is truly distinct from other constructs based on empirical standards. It is measured by calculating the Fornell-Larcker Criterion and Cross-Loadings. For the Fornell-Larcker Criterion, a construct is considered valid if the square root of its AVE is greater than its correlation with any other variable. Meanwhile, for Cross-Loadings, an indicator is deemed valid if its outer loading on its intended variable is greater than its loadings on any other variables. The results of the discriminant validity test can be seen in Tables V and VI.

TABLE V. CROSS LOADING VALUES

| | X1 | X2 | X3 | Y |
|---|---|---|---|---|
| X1.2 | **0.887** | 0.619 | 0.538 | 0.547 |
| X1.3 | **0.904** | 0.504 | 0.578 | 0.698 |
| X1.4 | **0.852** | 0.642 | 0.553 | 0.634 |
| X2.1 | 0.628 | **0.889** | 0.431 | 0.499 |
| X2.2 | 0.650 | **0.922** | 0.514 | 0.591 |
| X3.1 | 0.556 | 0.334 | **0.911** | 0.747 |
| X3.2 | 0.434 | 0.454 | **0.868** | 0.723 |
| X3.3 | 0.502 | 0.336 | **0.890** | 0.785 |
| X3.4 | 0.541 | 0.521 | **0.810** | 0.634 |
| X3.5 | 0.505 | 0.544 | **0.565** | 0.540 |
| Y.1 | 0.522 | 0.650 | 0.517 | **0.741** |
| Y.2 | 0.589 | 0.622 | 0.527 | **0.712** |
| Y.3 | 0.681 | 0.409 | 0.659 | **0.783** |
| Y.4 | 0.565 | 0.477 | 0.856 | **0.896** |
| Y.5 | 0.403 | 0.502 | 0.746 | **0.800** |
| Y.6 | 0.594 | 0.412 | 0.720 | **0.886** |
| Y.7 | 0.639 | 0.416 | 0.699 | **0.865** |

TABLE VI. FORNELL-LARCKER VALUES

| | X1 | X2 | X3 | Y |
|---|---|---|---|---|
| X1 | **0.816** | | | |
| X2 | 0.705 | **0.906** | | |
| X3 | 0.634 | 0.525 | **0.811** | |
| Y | 0.703 | 0.605 | 0.808 | **0.856** |

*c) Results of Structural Model (Inner Model) Evaluation*

The evaluation of the model was conducted by calculating several indicators, as follows:

- Results of Model Evaluation: Inner Model Test (R-Square)

The R-squared value is 0.7823 or 78.23%. This indicates that the exogenous latent variables are able to explain or predict 78.23% of the endogenous latent variable. An R-squared value of ≥ 0.10 is already considered capable of explaining the dependent variable.

- Evaluation of the Structural Model: Inner Model Test (Path Coefficients)

In this study, the Inner Model Test (Path Coefficients) was applied to evaluate the strength and direction of the relationships between the constructs. The coefficients indicate whether each X variable has a positive or negative effect on the Y variable, with values closer to +1 reflecting stronger positive associations and values closer to –1 reflecting negative associations [38]. The estimated coefficients derived from this model highlight the magnitude and direction of influence among the variables. The results of the inner model assessment are presented in Table VII and Figure 7.

TABLE VII. R-SQUARE

| | Y |
|---|---|
| X1 | 0.1983 |
| X2 | 0.1129 |
| X3 | 0.6711 |

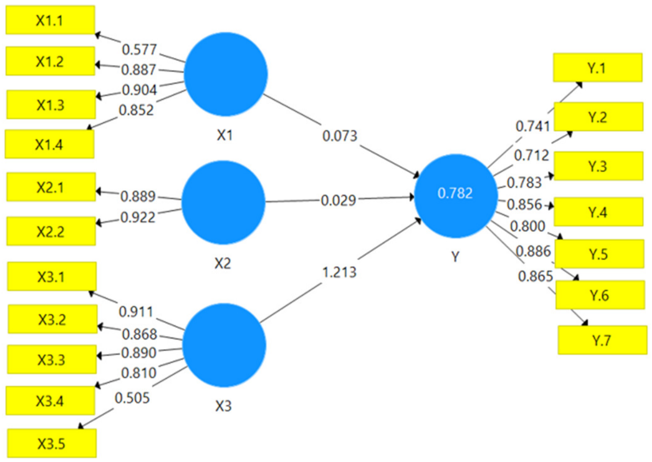


Fig. 7. Inner model test (path coefficient).

The research findings indicate the following directional influences of the variables:

1. X1 (Institutional Capacity Indicator) has a POSITIVE influence on Y1 (Outcome Indicator).
2. X2 (Development/Guidance Indicator) has a POSITIVE influence on Y1 (Outcome Indicator).
3. X3 (Supervision Indicator) has a POSITIVE influence on Y1 (Outcome Indicator).

- Hasil Hitung: Inner Model Test (Significancy T-Statistic)

The results of the Inner Model Test (T-Statistic) indicate the statistical significance of each independent variable. These values are obtained from the T-Statistic calculation, quantify the extent of each variable's effect on the dependent variable (Y). A variable is classified as significant if the P-Value is less than or equal to 0.05 ($P \leq 0.05$), or if the T-Statistic exceeds 1.96.

TABLE VIII. INNER MODEL TEST (SIGNIFICANCY T-STATICTIC)

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T-Statistics (\|O/STDEV\|) | P values |
|---|---|---|---|---|---|
| X1→Y | 0.1983 | 0.1820 | 0.1550 | 1.2788 | 0.2016 |
| X2→Y | 0.1129 | 0.1287 | 0.1571 | 0.7187 | 0.4726 |
| X3→Y | 0.6711 | 0.6749 | 0.0912 | 7.3605 | 0.0073 |

Equation (1) is obtained from the data analysis results:

$$Y = 0.1983X1 + 0.1571X2 + 0.6749X3 \quad (1)$$

These findings are consistent with international standards on infrastructure governance. The results underscore that robust oversight and transparency mechanisms are essential to mitigating the risks of cost overruns, delays, and corruption in public construction projects [39]. Effective monitoring and evaluation systems are critical to ensuring that public investments achieve their planned development objectives and to strengthening accountability across levels of government [40]. Therefore, the dominant influence of the supervision factor (X3) in this study confirms that effective oversight is not only vital at the local level, but also aligns with globally recognized principles of accountable and transparent infrastructure governance.

### *C. Analsysis of Crtitical Success Factors*

Based on the path coefficient values, a reduction of the main elements influencing the Performance Improvement of RAOs is carried out, from the largest to the smallest, to determine the magnitude of the influence of existing elements on the Performance Improvement of RAO. This can be elaborated as shown in Table IX:

Based on the path coefficient values, the ranking of the main elements influencing the Performance Improvement of RAOs, from the largest to the smallest is displayed in Table XI, to identify the relative strength of each element's contribution.

TABLE IX. RANK OF CRITICAL SUCCES FACTORS

| Variable | Analysis value | Rank | Indicator | |
|---|---|---|---|---|
| X3. Supervision | 0.6749 | 1 | X3.1 | Enforcement of orderly construction business practices. |
| | | | X3.2 | Enforcement of orderly construction service provision. |
| | | | X3.3 | Enforcement of orderly utilization of construction services. |
| | | | X3.4 | Administration of construction service information system data (SIPJAKI - SIJK). |
| | | | X3.5 | Availability of regulations (Government/Regional). |
| X1. Institutional capacity | 0.1983 | 2 | X1.1 | Application of organizational structure. |
| | | | X1.2 | Availability of human resources. |
| | | | X1.3 | Availability of financial capacity. |
| | | | X1.4 | Utilization of information technology. |
| X2. Development/Guidance | 0.1571 | 3 | X2.1 | Implementation of training and/or certification related to construction services. |
| | | | X2.2 | Implementation of technical guidance, workshops, refreshments, socialization, and/or seminars related to construction services. |

# IV. STUDY LIMITATIONS

This study has several limitations. First, the geographic coverage is limited to RAOs in Sulawesi Island and cannot be generalized to other regions in Indonesia. Second, the use of a cross-sectional design restricts the capacity to capture temporal dynamics or longitudinal trends. Third, the study did not measure direct implementation practices or measurable policy outcomes related to the identified critical success factors. These limitations should be considered when interpreting the findings and may serve as a foundation for future research directions.

# V. CONCLUSION

This study addressed performance gaps in Regional Apparatus Organizations (RAOs) within Indonesia's construction sector, which are primarily attributable to limited institutional capacity, weak development programs, and inadequate oversight. It identified three Critical Success Factors (CSFs): institutional capacity, development/guidance, and supervision. Employing a two-stage approach that combined a systematic literature review with quantitative validation through SmartPLS, the study found that supervision (0.6749) had the strongest effect on RAO performance, followed by institutional capacity (0.1983) and development/guidance (0.1571).

This research contributes a validated CSF model specific to public construction governance and provides actionable guidance for local governments to enhance institutional effectiveness. Future research could adopt a longitudinal approach, expand the geographic scope to Eastern Indonesia and Papua, and examine external influences such as national policy and budget structure. These findings reinforce RAO accountability and performance in managing public infrastructure.

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