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# Cost Planning Standards on Design and Build Contract Systems for Stadium Building Construction in Indonesia

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**Abstract** The study aims to determine and develop the following, (1) the components of standard and non-standard costs, as well as miscellaneous expenses related to financial accuracy, (2) the percentage standard of the works component, (3) the technical specification, (4) the range of costs per meter square and seat, and (5) the connection model between cost planning and accuracy through Indonesian design and build contract, to diminish the potential disputes among related stakeholders. The methods used included analytical, validity, reliability, and descriptive-analytical tests, through four steps of data collection, namely (1) pilot survey, (2) questionnaire, (3) expert validation, and (4) final expert validation. Furthermore, the data analysis was conducted using SPSS and SEM-PLS software, with the result showing that, (1) the components of standard and non-standard costs, as well as miscellaneous expenses were determined by the literature study and the validation of experts. These were also used as the identification sources of cost planning standard, (2) the percentage of the works' component was derived from the previous stadium construction projects and the utilized literature review, (3) the technical specification in the cost planning process differed with the needs of each stadium classification, (4) the cost/m$^2$ and cost/seat were used as the reference of the project owner to determine the estimation of each stadium classification, and (5) the standard cost and the miscellaneous expenses were positively related to the budget accuracy. Meanwhile, the non-standard costs had a negative effect on this accuracy. Based on this study, several implications were observed towards the global audience, as the guide to enhance the cost accuracy in the stadium's planning process through the design and build contract.

**Keywords** Stadium Building, Design and Build Contract, Cost Planning Standards

## 1. Introduction

The elevation of the infrastructural development budget and volume has reportedly demanded a faster construction process, procurement system modernization, as well as effective project delivery for users and service providers over the past five years. This requires the modernization of the local construction work procurement system and project delivery, to ease the achievement of national goals [1]. Based on the World Economic Forum (2019), the Global Competitiveness Index showed that the IICI (Indonesian Infrastructure Competitiveness Index) was globally, nationally, and continentally ranked 71st, 50th, and 4th in 2018-2019, respectively [2]. Under the leadership of the current president, infrastructural development has intensified over previous years, due to the increasing number of budgets and volumes, as well as the demand for faster execution times. In early January 2020, the Central Government issued the latest Ministerial Regulation on the method of infrastructural development, through the Ministry of Public Works and Housing. This was known as the MOPWH Regulation No. 1/PRT/M/2020 [3], concerning the Standards and Guidelines for the Procurement of Integrated Design and Build Contract.

Design and build is a method providing different techniques towards the completion of a project. It is also a unique and complex method with a practical combination from each of the different elements, to provide interest to designers and contractors, as well as a good community between each element [4]. The method is also an alternative enabling the unification of design and construction phases, where one entity provides two services (design and construction). This single point of responsibility allows the start of construction before the completion of the design. Moreover, the system essentially facilitates the adaptation of errors without a formal contracting process known as design completion [5]. According to the Design-Build Institute of America (2018), a study was conducted with 212 projects, where 53, 79, and 80 used the DBB (Design Bid Build), the CMR (Construction Manager at Risk), and the DB (Design-Build) procurement systems, respectively. The results showed that the DB system was the best, compared to the DBB and CMR structures. This indicated that the implementation cost and construction period of the DB procurement system were 0.3/1.9% cheaper and 36/13% faster than the DBB and CMR structures, respectively [6].

The design and build contract also possesses fast track characteristics, such as reducing the bidding time for construction service providers and contractors. This is often separately carried out with the selection and planning of consultant services, where the present design and build contract method reportedly responds to the challenges in enhancing the completion of a project, especially in Indonesia. However, the implementation of an integrated design and build contract still poses many problems for related parties in the construction sector, such as miscommunication, which causes work errors, as well as the losses of time, cost, and quality to the project. Many resources have reportedly been required to estimate project costs, including time, information, various personnel, and the budget model. This is due to the difficulties in accurately estimating the project budget before implementation, based on the lack of construction information, whose quality is one of the main factors to improve accuracy [7, 8, 9].

The selection of the stadium building is due to the absence of standard policies or regulations at the national and international levels, which often causes disputes during the audit process. This is subsequently supported by the several national and international sporting events to be held in Indonesia for the next few years, due to the intensification of sports tourism in the country. Based on the issues of the contractual method implementation and the above potential infrastructural development, the performance of a study to improve cost accuracy in the planning process is essentially necessary for stadium construction in Indonesia, using the design and build contract model. This is expected to provide several implications to the global audience, as the guide to enhance the cost accuracy in the planning process of stadium construction.

## 2. Literature Study

### 2.1. Design and Build Contracts

This is described as a procurement method, where a single entity or consortium is contractually responsible for the design and construction of a project [10]. Meanwhile, it was labelled as a project delivery method by [11] in [12], where the owner provides user requirements (owner requirements) for a predetermined design, while also assigning a contract to a suitable company for simultaneous performances. The Design and Build contract procurement approach is also found with the ability to thrive and be protected in the global construction industry. This is due to the multiple benefits derived from one procurement approach over another, especially the traditional/conventional options characterized by inherent fragmentation, leading to time and cost overruns. The approach also differs from other procurement techniques, based on its advantages in providing a single point of responsibility, inherent buildability, and centralized risk allocation [13].

This shows that the advantages of a project implementing a design and build contract system focus on one-point responsibility, cost savings without sacrificing quality, reduced schedule, improved communication, and decreased litigation (lawsuits) associated with the errors and negligence transferred from the owner to the selected contractor [12]. The method is also classified as risky to most projects, due to the combination of design activities and construction processes, as well as the on-site supervision and high-uncertainty realistic work participation by contractors and clients [13].

### 2.2. Stadium Building Projects in Indonesia

To improve the achievements of the national soccer sport, the President reportedly stipulated Presidential Instruction Number 3 of 2019, concerning the Acceleration of National Football Development. This needs to carry out several coordinated and integrated steps according to the duties, functions, and authorities of each Ministry/Institution. These are based on ensuring the improvements of national and international sports achievements, through the provision of Football Stadium infrastructure and facilities [14]. In the Data Architect (vol. II), the stadium was defined as a spectators' facility and a building for organizing football and athletic activities. Stadium building planning was also defined as the technical requirements set by national and international sports organizations, for football, athletics, or other activities [15]. In addition, environmental suitability is known as a major consideration for selecting a location to be used as a stadium. This indicates that the factors to be considered in building a stadium include the following [16]:

1. Vehicle circulation,
2. Appropriate pedestrian streets,
3. Building lighting,
4. Connection with the building and the surrounding community,
5. Appropriate scale of the project and its environment.

### 2.3. Gaps in Knowledge

**Table 1.** Characteristics of Design and Build Methods Based on Literature Studies

| **Design and Build Characteristics** | **Writer** |
|---|---|
| One point responsibility | Seng & Yousof, (2006); Skitmore & Ng, (2002) |
| Compressed Delivery schedule | Abdulrashid, (2002); Oztas & Okmen, (2004) |
| Risk allocation | Hassim *et., al.* (2008); Muhammad, (2005); Beard et., al. (2001) |
| Complexity | Abdulrashid, (2002); Chan & Yu (2005) |
| Communication | Chan *et., al.* (2001); Levy, (2006) |
| Effective client representation | Lam *et., al.* (2004); Peterson & Murpheree, (2004) |
| Facilitating the use of the latest innovative technologies | Ling, Chong & Ee (2004); Abdulrashid, (2002) |

This states that the Integrated Design and Build Contract is a performance related to the construction of a building or other physical manufacturing forms [3]. Therefore, the design work is integrated with the construction phase, with the contract approach being a procurement method where a single entity or consortium is contractually responsible for the project performances [10]. Moreover, the design and build contract is a business service provided by Integrated Construction, showing the integration of services between Constructive Works and Consultancy, although does not include the procurement process. This construction is subsequently regulated by Law No. 2/2017 and Government Regulation No. 29/2000, concerning the Integrated Design and Build Construction and the Implementation of Building Services, respectively. Using the design and build contracts in Indonesia, the regulations governing the implementation of development work are found to still presently focus on the Ministerial Regulation No. 1 of 2020. This is based on the Standards and Guidelines for the Procurement of Integrated Design and Build Construction Works (Design and Build). In addition, another law comprehensively governing this approach is the Ministerial Public Works and Housing Regulation No. 1/PRT/M/2020 [3], concerning the Standards and Guidelines for the Procurement of Integrated Design and Build Construction.

Based on several previous studies as shown in table 1, the advantages of implementing design and build contracts include the following:

1. Design and build projects utilize less time and lower the growth cost [11].
2. The design and build contracts are cost, time, and quality friendly, depending on the project owner and user in the survey data [17].
3. In design changes, Perkins [18] stated two merits in the implementation of this method as follows, (a) Design errors no longer cause changes in the construction phase and collaboration among designers, and (b) Builders and contractors allow the sharing of skills, indicating the reduction of costs and construction time.

According to Fig. 1, the substances of state-building financing include the following [19],

a Cost components for the construction phase,
b Standard and non-standard costs,
c The highest standard unit price,
d The complement of other work costs with the construction process,
e Maintenance costs.

Standard costs are used for the implementation of construction works, including architecture, structures, utility, plumbing, lighting, network installations, and finishing performances. From the Indonesian Government regulation, these costs include construction overhead, insurance, work safety, inflation, and taxes. Meanwhile, non-standard costs are used to implement the works not found in the standard budgets, such as permits (excluding building and utility connections permits). In construction works, these costs include land preparation and clearing improvement of architectural and structural building performances. This indicates that building completeness contains mechanical and electrical work and green buildings [3].

Based on the results of the above literature, the present regulations did not include the details supporting increased cost accuracy in construction planning, using design and build contracts, especially for Indonesian stadium projects.

## 3. Methodology

### 3.1. Identification of Study Variables

A study variable is an inter-related attribute, value, or nature of an object/activity, pre-determined and studied by experts to achieve conclusions [20]. These are often interpreted as the variations of a report symptom (study target) [21]. In this present study, two variables were used based on roles, namely independent and dependent factors, as indicated in the table 2. The independent variables (X) are known to affect or cause changes to the emergence of the dependent factors [21]. The variables also preceded the dependent factors, with an explanation being divided into key causal indicators. Other variables are found to also influence the dependent variable (Y), which is specifically known as an output factor, criterion, or consequence.

**Table 2.** Dimensions and Indicators of the Research Variables

| Var. | Indicator |
|---|---|
| **X1** | **Standard Costs** |
| X1.1 | Work Component |
| X1.2 | Standard Area |
| X1.3 | Number of Floors |
| X1.4 | The highest unit price for a state building |
| X1.5 | Construction Cost Index |
| **Var.** | **Indicator** |
| **X2** | **Non-Standard Costs** |
| X2.1 | Volume Details |
| X2.2 | Building and Environment |
| X2.3 | Special Functions |
| X2.4 | Other Jobs |
| **Var.** | **Indicator** |
| **X3** | **Miscellaneous expenses** |
| X3.1 | Building Construction Permit |
| X3.2 | Internet Connection Fee |
| X3.3 | Soil Investigation Test |
| X3.4 | Cost of Safety<br>*(Construction Safety Management System)* |
| **Var.** | **Indicator** |
| **Y** | **Cost Accuracy** |
| Y1.1 | Scope Quality |
| Y1.2 | Information Quality |
| Y1.3 | Level of Work Dissatisfaction |
| Y1.4 | Estimator Performance |
| Y1.5 | Estimation Procedure |

### 3.2. Study Methodology

Data was obtained through the design of a questionnaire, which was tested and distributed after passing the improvement stage and expert validation. The improvement stage contained 12 (twelve) indicators, namely (i) bill of quantity (BoQ), (ii) detailed engineering design (DED), (iii) Project Charter, (iv) Definition of the work, (v) Results/Job Output, (vi) Hierarchical Breakdown of works, (vii) Flexibility, (viii) Project Life Cycle, (ix) Complexity, (x) Resource Allocation, (xi) Monitoring, and (xii) Risk Identification. The study stages are presented in Fig. 1.

This began by identifying the challenges related to the implementation of design and build projects in stadium construction, which was then carried out by compiling an operational model to create problem-solving ideas. In this study, qualitative methods were used to answer the objectives, with the data collection process being carried out using a pilot survey, respondent questionnaires, and expert validation. Furthermore, the data obtained were used to answer the questions on the standard cost planning of a design and build contract system, based on the construction of stadiums. These subsequently analyzed the archives and data obtained from the stadium's Terms of References, Bill of Quantity (BoQ), as well as Public Works and Housing Ministerial Regulation No. 22/2018. Table 3 indicates the sample of cost calculation standard which is derived from the result of the above analysis.

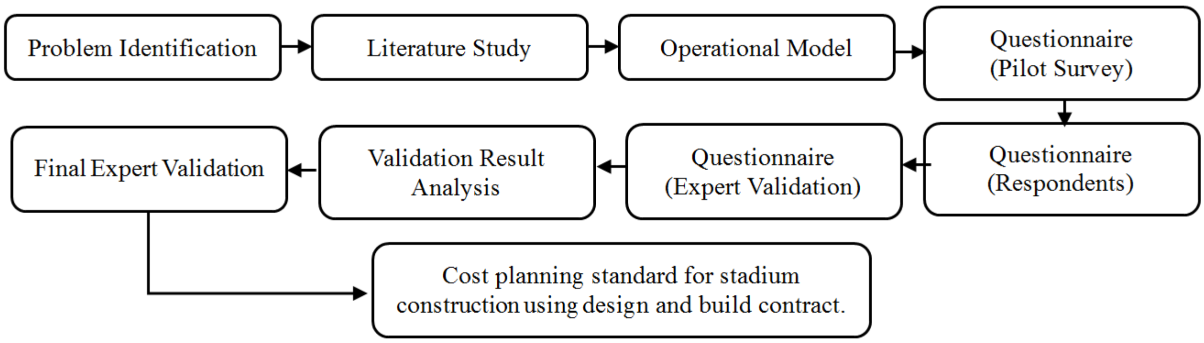


**Figure 1.** The Study Stages

**Table 3.** Sample of Cost Calculation Standards

| WBS LEVEL 5 | | | BUDGETING | |
|---|---|---|---|---|
| **CODE** | **JOB ACTIVITIES** | **Description** | **Unit** | **Price** |
| 2.1.4.1.1 | Making Figures of Technical Plans for Structural Works | Technical Report | Book | $ 52 |
| | | Tender Document | Book | $ 181 |
| | | Figure A3 | Sheet | $ 0.35 |
| 2.1.4.1.2 | Making Figures of Architectural Work Technical Plans | Technical Report | Book | $ 52 |
| | | Tender Document | Book | $ 181 |
| | | Figure A3 | Sheet | $ 0.35 |
| 2.1.4.1.3 | Making Mechanical Work Technical Plan Figures | Technical Report | Book | $ 52 |
| | | Tender Document | Book | $ 181 |
| | | Figure A3 | Sheet | $ 0.35 |
| CODE | JOB ACTIVITIES | Description | Unit | Price |
| 2.2.1.1.1 | Road Designated Area Cleaning | Site Clearing And Leveling Works | $m^2$ | $ 1.60 |
| | | 1 m2 Site Clearing and levelling | $m^2$ | $ 1.74 |
| 2.2.1.1.2 | Temporary Road Construction | Temporary Road Construction Works | $m^2$ | $ 14.69 |
| | | | $m^2$ | $ 20.71 |

3.2.1. Data Collection Phase I

Data collection was conducted through the distribution of questionnaires to 70 respondents, to determine the indicators and elements of each variable influencing cost planning standards in stadium construction. As shown in the table 4, the respondents are categorized by three criteria, namely education, position and work experience.

**Table 4.** Categories of Respondents

| Code | Criteria for Education |
|---|---|
| 1 | Undergraduate |
| 2 | Postgraduate |
| 3 | Doctoral |
| **Code** | **Criteria for Position** |
| 1 | Staff |
| 2 | Manager |
| 3 | Top Management |
| **Code** | **Criteria for Work Experience** |
| 1 | 0-5 |
| 2 | 6-10 |
| 3 | 11-15 |
| 4 | 16-20 |
| 5 | 21-25 |
| 6 | 26-30 |

3.2.2. Data Collection Phase II

The questionnaire was then tested (pilot survey) on the respondents, to determine the validity and reliability. This aimed to improve the sentence structure of the questionnaires, to enable the respondent to understand the questions before being distributed to the real participants in stage III. At this stage, the respondent's criteria for data collection focused on the possession of at least S1 in the field of Civil Engineering/Architecture/Accounting, and also a minimum of 3 years of work experience in the construction sector.

3.2.3. Data Collection Phase III

In phase III, data collection was carried out based on the influential levels of the obtained variables. This indicated that the questionnaire submitted to the respondents was to obtain the information regarding the assessment of standard and non-standard costs' indicators, as well as other variables affecting the budget accuracy.

3.2.4. Data Collection Phase IV

Phase IV involved the utilization of interviews and evaluations, to carry out expert validation. This was conducted by 5 experts with a minimum educational background of a master's degree, as well as proficiency in the construction, contract, and project management fields. They should also be Government-certified practitioners with a minimum of 10 years of working experience and an expertise certificate (SKA), to obtain suggestions or criticism.

# 4. Result and Discussion

## 4.1. The Components of Standard and Non-Standard Costs, as well as the Accuracy-based Miscellaneous Expenses

Using the SPSS and SEM-PLS programs, a list of components affecting the standard, non-standard, and miscellaneous costs was obtained. For the standard costs, these components included the work component, technical specifications, moderate area, seat numbers, the highest unit price for state buildings, and the CCI (construction cost index). The components affecting the non-standard costs were also the volume details, buildings and environment, as well as the special functions and work support. However, the components affecting other costs were the building construction permit, soil investigation test, and safety budgets. The results also showed that the components without a high significance for other costs were observed, namely the internet connection budgets.

## 4.2. Percentage of Works Component on Stadium Project

The percentage range of the total stadium construction was obtained based on the work clusters categorized in the WBS. This was used to determine the lower and upper limits of each stadium construction clump, due to the historical data from several previous projects. Using the formula expressed in Fig. 2, the upper and lower limits of the cost percentages were obtained as shown in Table 5, where the Kolmogorov-Smirnov (K-S) test was used. This is an alternative non-parametric test, using the cumulative distribution to decide the specific flow of the data [23], where x = the cost proportion average of each stadium construction component in a specific class, and E = the error value of statistical calculations.

$$\overline{x} - E < \mu < \overline{x} + E,$$

**Figure 2.** The Kolmogorov-Smirnov Test Formula

**Table 5.** Range of Work Based on Stadium Class

| No | Stadium Classification | Stadium Type A | Stadium Type B | Stadium Type C |
|---|---|---|---|---|
| 1 | Sitework Job Percentage | 2.08% - 3.49% | 1.50% - 3.18% | 1.35% - 2.89% |
| 2 | Structure Job Percentage | 23.84% - 34.60% | 22.35% - 33.45% | 20.89% - 32.67% |
| 3 | Architecture Job Percentage | 13.26% - 17.72% | 12.89% - 16.87% | 9.32% - 13.70% |
| 4 | Mechanical Job Percentage | 6.27% - 8.93% | 5.38% - 8.64% | 4.89% - 7.90% |
| 5 | Electrical Job Percentage | 12.31% - 17.81% | 10.35% - 15.76% | 9.33% - 13.71% |
| 6 | Exterior Job Percentage | 19.60% - 30.62% | 18.74% - 29.34% | 10.24% - 16.58% |
| 7 | Miscellaneous Job Percentage | 5.74% - 8.20% | 3.89% - 4.48% | 3.77% - 4.46% |

### 4.3. The Technical Specifications on the Stadium Project

**Table 6.** Technical Specification of Precast Pile Foundation Work

| Stadium Classification | Technical Specification |
|---|---|
| Type A | K-600 reinforced concrete, Diameter 60 cm or more |
| Type B | Reinforced concrete Fc 25 Mpa or more, Diameter 60 cm or more |
| Type C | Reinforced Concrete Fc 25 Mpa or more, Diameter 60 cm or more |

**Table 7.** Technical Specification of Column Concreting

| Stadium Classification | Technical Specification |
|---|---|
| Type A | Reinforced concrete Fc 45 Mpa or more |
| Type B | Reinforced concrete Fc 33.2 or more |
| Type C | Reinforced concrete Fc 33.2 or more |

These were derived from the technical specification documents of previous construction projects, indicating that the results obtained for each type of stadium were used in determining the standard cost/m$^2$ and cost/seat for the design and build contract facility. Examples of the specifications for each stadium building are shown in Tables 6 and 7.

### 4.4. The Range of Costs/M$^2$ and Costs/Seat on the Stadium Project

Using Monte Carlo simulation with Crystal Ball software, comparative results were obtained to determine the maximum and minimum costs in stadium construction, based on the infrastructural class classification. This was in line with the stadium construction costs/m$^2$, costs/seats, and percentage range. The utilized building budget was also based on the clump of stadium construction performances. This indicated that a Monte Carlo (Crystal Ball) software was used for data analysis, to obtain the stadium's average cost per seat, as shown in Figs. 3 and 4. Monte Carlo is a stochastic (deterministic) simulation method that uses random data to obtain numerical results [24]. The simulation is financially used to value and analyze instruments, portfolios, and investments. This is often carried out by simulating the various sources of uncertainty, which affected their values. It also helps in determining their average values over the range of resultant outcomes. In addition, the Monte Carlo analysis was adopted to estimate the risks of public investment projects [25,26].

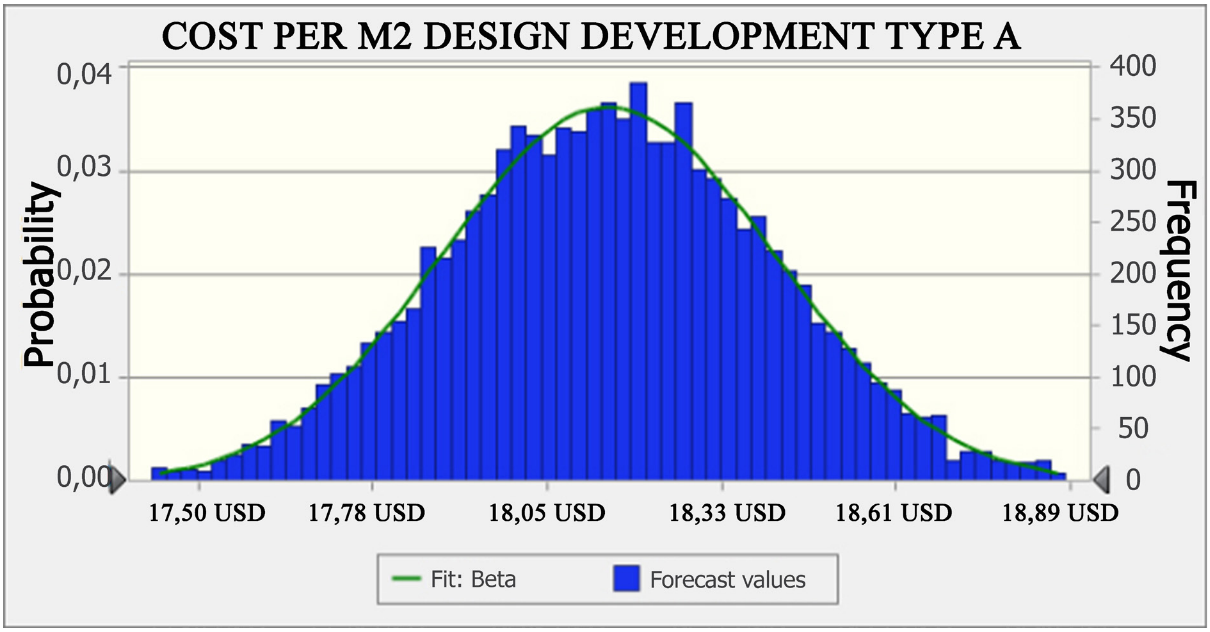


**Figure 3.** Cost Per $M^2$

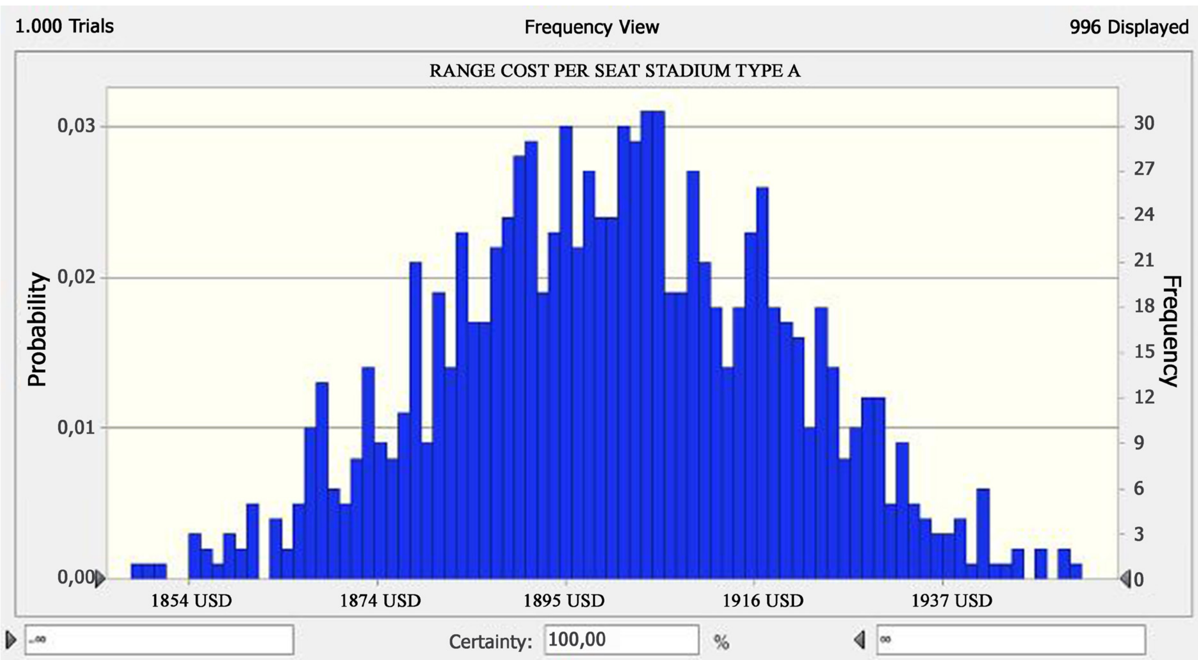


**Figure 4.** Range Cost Per Seat

**Table 8.** The Cost Per Metre Percentage

| No. | Stadium Classification | Cost Limit Per $m^2$ |
|---|---|---|
| 1 | Class A Stadium | $ 978 – $ 1,041 |
| 2 | Class B Stadium | $ 761 – $ 818 |
| 3 | Class C Stadium | $ 734 – $ 803 |

Based on Table 8, the cost for building a class A, B, and C stadium (/$m^2$) was between $978-$1,041, $761-$818, and $734-$803, respectively.

**Table 9.** Table of Cost Per Seat Percentage

| No. | Stadium Classification | Cost Limit Per Seat |
|---|---|---|
| 1 | Class A Stadium | $ 1,908 – $ 2,038 |
| 2 | Class B Stadium | $ 1,841 – $ 2,014 |
| 3 | Class C Stadium | $ 1,773 – $ 1,944 |

From Table 9, the construction cost of class A, B, and C stadium (/seat) was between $1,908-$2,038, $1,841-$2,014, and $ 1773-$ 1,944, respectively.

### 4.5. The Connection Model between Cost Planning and Accuracy

The Structural Equation Modeling described in [27], is a statistical method used to examine the relationship between manifest (observed) and latent (unobserved) variables, namely X1 (Standard Costs), X2 (Non-Standard Costs), X3 (Other Costs), and Y (Cost Accuracy). Using SPSS software, a homogeneity test was conducted with the following hypotheses:

- $H_0$: There is no comprehensive difference in each group of respondents.
- $H_1$: There are comprehensive differences in each group of respondents.

This showed that all indicators achieved the Kruskal-Wallis test parameters, with no difference perceptively observed on the Work Experience category, as shown by all the factors' Asymp.Sig values above 0.05. According to the Kruskal-Wallis test, all the indicators achieved the analytical parameters by eliminating R.8, R.59, R.60, R.44, R.48. This indicated that no difference was perceptively observed on the position, as shown by all the factors' Asymp.Sig values above 0.05.

**Table 10.** Reliability Test Results

| Reliability Statistics | |
|---|---|
| **Cronbach's Alpha** | **N of Items** |
| 0.937 | 19 |

As can be seen in table 10, from the reliability test, 19 utilized indicators had a Cronbach's Alpha value of 0.932, indicating that the levels above 0.6 were reliable. In addition, the data adequacy was analyzed using the KMO & Bartlett's Test, as shown in Table 11.

Based on Table 11, the KMO value was 0.855 > 0.5, indicating that the study sample was sufficient. It also showed that Bartlett's Test of Sphericity had a significance value of 0.000 < 0.05, indicating a significant correlation between the variables.

**Table 11.** Data Sufficiency Test

| KMO and Bartlett's Test | | |
|---|---|---|
| **Kaiser-Meyer-Olkin Measure of Sampling Adequacy.** | | **0.855** |
| **Bartlett's Test of Sphericity** | 841.077 | 841.077 |
| | 171 | 171 |
| | 0.000 | 0.000 |

**Table 12.** Extracted Average Variance of Loading Factor

| Variable | Cronbach's Alpha | rho_A | Composite Reliability | Average Variance Extracted (AVE) |
|---|---|---|---|---|
| X1 | 0.875 | 0.878 | 0.909 | 0.668 |
| X2 | 0.823 | 0.833 | 0.870 | 0.527 |
| X3 | 0.813 | 0.819 | 0.877 | 0.642 |
| Y | 0.768 | 0.781 | 0.848 | 0.583 |

Parameters must be achieved on all variables with Cronbach's Alpha value > 0.6 and Composite Reliability value > 0.7. It can be seen in Table 12 that the Cronbach's Alpha value for each indicator has exceeded the parameters that have been set, as well as for the Composite Reliability value for each indicator.

**Table 13.** Path Coefficient

| | X1 | X2 | X3 | Y | Description |
|---|---|---|---|---|---|
| X1 - Standard Fee | | | | 3.168 | Positive Effect on Y |
| X2 – Non-Standard Fee | | | | 2.452 | Negative Affect on Y |
| X3 - Miscellaneous Expense | | | | 6.799 | Positive Effect on Y |

According to Table 13, there was a positive relationship between X1, Y, and X3. However, X3 and X2 had positive and negative relationships with Y, respectively. The Loading Factor output also showed that X1.2 (Information Quality) and X1.5 (Estimation Procedure) did not meet the Composite Reliability value parameter > 0.7, leading to their removal from the relationship analysis.

**Table 14.** The T-Statistics (Bootstrapping)

| T- Statistic | | | | | |
|---|---|---|---|---|---|
| **Indicator** | **Original Sample (O)** | **Sample Mean (M)** | **STDEV** | **T Statistic** | **P Values** |
| X1. Standard Cost, Cost Accuracy | 0.398 | 0.403 | 0.126 | 3.168 | 0.002 |
| X2. Non-Standard Fee, Cost Accuracy | -0.376 | -0.365 | 0.153 | 2.452 | 0.015 |
| X3. Miscellaneous expense, Cost Accuracy | 0.833 | 0.819 | 0.122 | 6.799 | 0.000 |

Using the experts' validation analysis, the relationship model was achieved between the indicators, as well as the WBS and SMM variables affecting the accuracy of the work volume. The mathematical model which is taken from Original Sample in Table 14 was also obtained for Y = 0.398 X1 – 0.376 X2 + 0.833 X3. In addition, the variables affecting the accuracy levels in work calculation included,

- X.1 (Standard Cost): This affected the calculation accuracy of the work volume by 39.8%.
- X.2 (Non-Standard Costs): This affected the calculation accuracy of the work volume by 37.6%.
- X.3 (Other Costs): This affected the calculation accuracy of the work volume by 83.3%.

## 5. Conclusion and Suggestions

The estimates of construction cost provided a specific primary indication of a project's total cost. This indicated that cost estimation was used to achieve a contract price, according to the agreement between the project owner and the contractor, to determine and control the construction budgets. These is the series of costs required for project implementation, which is financially realistic than the actual budgets. Therefore, the preparation of a cost planning standard was able to facilitate the compilation of financial estimates, to improve calculation accuracy. The preparation of this standard was also the main goal as a problem-solving technique in the application of design and build, especially within the construction of stadium facilities. In this study, the cost planning standards included the identification of technical work specifications, based on the understanding of Stadium project WBS. This was used as a guideline in preparing terms of reference and BoQ, before the creation of the overall construction cost estimates.

For moderate stadium construction cost planning, the standard, non-standard, and miscellaneous budget components were utilized. When planning to build a stadium for national purposes, the accuracy model was calculated through the cost/seat and cost/$m^2$ method, which was adjusted to the 3 different categories, namely class A, B, and C facilities. Some of the challenges experienced in this study include the difficulty of obtaining literature from journals. This was because no previous study had been conducted based on the design and build contracts for stadium buildings. Besides that, difficulties were also encountered in obtaining complete stadium construction project data, due to the benchmark implementation year being very far from this present study. Despite this, the study process was smoothly operated with the expected results, to broaden the related field of concentration. Based on these conditions, subsequent future reports should also focus on other categories of state buildings. The results should also be intensively communicated to the related stakeholders using the design and build contract method, for the improvement of the project accountability often funded by the state or regional budgets. Therefore, this study should be used in improving and updating the Indonesian Ministerial Regulation of Public Works and Housing, concerning the Design and Build Contract System.

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