

Development of Cost Planning Standards for Design Development, Sitework, and Structure for Stadium Area Works on Integrated Contracts for Main Stadium Building Based on Indonesian Minister of Public Works Regulation Number 22 of 2018 to Improve Cost Accuracy

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Abstract

Increasing development and future planning on the sports tourism in Indonesia, is not in line with the planning execution process, particularly on the construction plan application process in several big projects especially stadium construction. Ironically, stadium that can be classified as *Bangunan Gedung Negara*, should be one of the most important buildings which could be the main cantilever for all of the sports tourism activities and planning in Indonesia. This thing could be happened because there were not any policies has been made and issued by the Indonesian's government institutions, which contains standard and clauses of stadium construction in particular. Moreover, the complexity rate of stadium construction process is also requiring the most efficient and effective method, particularly in cost planning, thus the project delivery accomplishment process can be conducted with a high accuracy rate. This degree of accuracy became so important, because there is a probability of project cost differ from the planning could be happened. Furthermore, there is a likelihood of dispute occurrence as the impact of the inaccurate cost planning in the project beginning. Because of that, the design and build method could be one of the best choices, as long as can be implemented following the standards that have been tested against the cost planning accuracy rate. However, because this kind of method has not been contained in any existing national standards, thus a development against the existing policies and standards became so crucial, in order to assisting the national planning and development especially in the sports tourism area. Therefore, a development for the existing policies that is the closest-to-be the solution of the issues above, which is *Permen No. 22* issued in 2018, need to be conducted as soon as possible.

Keywords— Cost Planning Standards, Main Stadium Building, Design and Build, Cost Accuracy

I. INTRODUCTION

The concept of stadium development has developed rapidly, where stadium design must focus on the need for community-friendly structures that provide the maximum level of safety and comfort, as an architectural icon in the urban landscape that has a major impact on the surrounding community and its infrastructure, designed for the needs of the community, maximizing potential commercial operations, and incorporates the latest

technological advances to offer the best facilities for the community (UEFA, 2011). The main stadium building itself is divided into 3 types, namely Type A (International), Type B (National), and the last is Type C. The differentiators for these 3 types are based on the capacity of the audience, the number of 100 m running tracks, and the 400m running tracks. The larger the scale of the Main Stadium Building type, the greater the capacity. Standardized work cost planning is very

important for Stadium Main Building Works because it will produce a validated, universal, written, transparent, and agreed-upon cost planning standard for all parties. The standardized method of measuring the volume of work has the main objective of increasing the accuracy of the calculation of the volume of work. This can have an impact on reducing the difference in the calculation of results between the construction service provider appointed to carry out the Design and Build contract with the auditor/owner. In addition, another positive impact is that of course it can reduce the possibility of disputes and has an indirect impact on saving time, costs, and maintaining relations between stakeholders.

The construction of the main stadium and its complementary sports venues are often required to be completed in a relatively fast and limited time to meet the demands of the timeline of the event to be held. Efforts to reduce or control the time of building construction work can be done by choosing the right form of contract. Therefore, the main stadium building is also included in the project criteria that can be carried out using an integrated design-build contract according to PUPR Ministerial Regulation Number 1/PRT/M/2020. According to the regulation, design and build integrated construction work is defined as all work related to the construction of a building or the construction of other physical forms, where the design work is integrated with the construction implementation. In stadium construction, Design and Build Integrated Contracts are often used as an effort to streamline time, by eliminating the bidding process for construction service providers and preparing planning documents because one party is directly appointed to design and build at the same time. There are fewer stakeholders involved so they don't have projects. In addition, the design-build contractor can create the building as long as it is in accordance with the contract value and the owner's specifications or criteria.

II. LITERATURE REVIEW

State Building

According to the Presidential Regulation of the Republic of Indonesia Number 73 of 2011 concerning the Construction of State Buildings, it is explained that a building is a building for service purposes which becomes state/regional property and is held with funding sources originating from APBN and/or APBD funds, or other acquisitions. legitimate. Building construction is the activity of constructing a state building which is carried out through the technical, implementation, and supervision stages, both construction of new buildings, building maintenance, as well as expansion of existing buildings, and/or continuation of building construction.

There are 3 stages of Construction of State Buildings, which consist of the preparation stage, the technical planning stage, and the construction implementation stage (Peraturan Menteri Pekerjaan Umum Nomor 22/PRT/M/2018 Article 3 concerning Technical Guidelines for the Construction of State Buildings). These stages should be carried out in accordance with the technical guidelines for the construction of state buildings in Permen PU No. 22 Tahun 2018 :

- 1.The implementation of the construction of state buildings includes the construction maintenance phase.
- 2.The implementation of construction is the implementation stage of constructing buildings, whether it is a new construction, partial or total renovation, expansion of existing buildings, continuation of maintenance (rehabilitation, renovation, restoration) carried by using construction service provider according to the requirement.
- 3.The implementation of construction is carried out based on the contract documents that have been signed by both parties.

Design and Build

Design and Build is a construction contract for work related to the construction of a building where the provider has one unit of responsibility for the design and

implementation of construction (PUPR, 2020). Another definition of a design and build contract is a contract for all work related to the construction of a building or the manufacture of other physical forms, where the design work is integrated with the construction implementation (Ministerial Regulation of PUPR No.1 of 2020). Design and build integrated construction works can increase innovation and accelerate the development of quality infrastructure. Design and Build is a construction contract for work related to the construction of a building where the provider has one unit of responsibility for the design and implementation of construction (PUPR, 2020). This Design and Build is different from the conventional method where the Service User does not need to prepare a Detail Engineering Design (DED), but only prepares a basic design.

Stadium main building

According to Minister of Youth and Sports Regulation No. 400 of 2013, a stadium is a piece of sports infrastructure that must be predominantly used for sporting activities/practices. The stadium is prioritized as a center for athletics and football. However, because the stadium is equipped with stands

with sufficient seats for spectators and a reasonably wide arena, it can be used for a variety of non-sports activities, such as music concerts, religious activities, social activities, and other activities that involve visitors. In general, stadium work is separated into three parts: the main stadium building, field of play, and Stadium Area. The scope of work on the main stadium building zone includes:

- a. Spectator Tribune Area
- b. Athlete/Player Facilities
- c. Activity Management Facility
- d. Building Management Facility
- e. Media Facilities
- f. Commercial Area

Standard Cost

Standard cost is used for standard physical construction works such as architectural, structural, utility works which include plumbing work, lighting, installation, and finishing. The overhead cost of carrying out construction work, insurance, work safety, inflation, and taxes in accordance with the provisions of law and regulations are also included in the standard cost. The followings are indicators for the standard cost used in this study, there are 5 indicators as described in table 2.1 below.

Table Error! No text of specified style in document..1 Indicators and Variables of Standard Cost

No	Variable	Indicator	Reference
1	Standard Cost	Work component	Jauzy A. (2012); BPSDM PUPR (2016); Kementerian PUPR (2017)
		Extensive standard	Jauzy A. (2012); BPSDM PUPR (2016); Kementerian PUPR (2017); Permen PU (2018)
		Number of floors	Jauzy A. (2012); BPSDM PUPR (2016); Kementerian PUPR (2017)
		The highest unit price for state buildings	Jauzy A. (2012); BPSDM PUPR (2016); Kementerian PUPR (2017)
		Construction cost index	Hikmah J. dan Idris (2019)

Non-Standard Cost

Non-standard cost is the cost incurred for the implementation of non-standard construction such as: permits other than Izin Mendirikan Bangunan (IMB) and the installation of other utilities, land preparation, improvement of architectural and structural work, building

special equipments for mechanical and electrical building works, and specifically for environmentally friendly buildings (Peraturan Presiden No. 73 Tahun 2011). The followings are indicators for non-standard cost variables used in this research, there are 4 indicators as described in table 2.2 below.

Table Error! No text of specified style in document..2 Indicators and Variables of Non-Standard Cost

No	Variable	Indicator	Reference
1	Non-Standard Cost	Volume details	Jauzy A. (2012); BPSDM PUPR (2016)
		Buildings and environment	Kementerian PUPR (2017)
		Significant function	Kementerian PUPR (2017); Permen PU (2018)
		Other works	Kementerian PUPR (2017)

The Relation of Standards Planning and Permen PU No. 22 Tahun 2018 to Improve Cost Accuracy

Based on the journal from (Muhammad T. Hatamleh, 2017) which examines the factors that affect the accuracy of project costs and

added with an understanding of the rules and regulations related to the Integrated Design and Build contract of the State Building in Permen PU No. 22 Tahun 2018. Then the synthesis of research or the relation between variables is obtained as explained in table 2.4 below..

Table Error! No text of specified style in document..4 Research Synthesis – Relation Between Variables

No	Relation Between Variables	Reference
1	Standard Cost → Non-Standard Cost	Permen PU No. 22 (2018); Perpres No. 73 (2011)
2	Standard Cost → Cost Accuracy	Muhammad T. H (2017); Alfredo F. (2005); Mamik R. (2007); Pradana & Miftahul (2019)
3	Non-Standard Cost → Cost Accuracy	Muhammad T. H (2017); Alfredo F. (2005); Mamik R. (2007)

As seen from table 2.4, the development of standards planning for Design Development, Sitework, Structure Work on the stadium are works was designed on an Integrated Design and Build contract of the state building based on Permen PU No. 22 Tahun 2018 as an effort to improve cost accuracy..

Problem Statement

Variables and indicators that can improve cost accuracy are identified through this research. The research objectives in this study include how the relationship between cost accuracy and cost planning standards in the scope of Design Development, Sitework, and Structure work on the Main Stadium Building is based on the Minister of Public Works Regulation No. 22 of 2018. It is envisaged that via the development of this research, the integrated contract system for design and construction that is controlled in Minister of Public Works Regulation No. 1 of 2020 will be accepted and

optimized, preventing disputes between the service provider and the owner.

III.METHOD

The research method is also the method used about the process that is passed in research and discussion of the concept of various methods, their strengths and weaknesses (Tamara, 2008). So it can be said that the research method is a strategy used to answer the formulation of the problem. The research method is carried out by identifying the stages in conducting research which will be explained further in the following subchapters. Chapter 3 will describe the research methodology consisting of research strategies, research processes consisting of research variables, research instruments, data collection processes, and data analysis methods. After all these processes have been carried out, the Planning and Development of Standards for Design Development Work, Sitework, and Structures for the Main Stadium Building Works is carried out on an Integrated Contract

for the Design of State Buildings based on PUPR Ministerial Regulation No. 22 of 2018 based on PUPR Ministerial Regulation No. 22 of 2018 based on the results of the research question which contains the identification of the Planning Development Work, Sitework, and Structure Costs for the Main Stadium Area Building Work on the Integrated Contract for the Design of State Buildings Based on the PUPR Ministerial Regulation No. 22 of 2018 which can be used to increase cost accuracy.

Materials

To achieve the objectives of this research, research strategies are needed so that the research becomes easier, structured, neat, efficient, and effective. The definition of research strategy itself is one way to collect data consisting of object, subject, variable, and the problem that is being studied so that the data will be directed at the goals to be achieved (Sukmadinata, 2005). The grouping of research strategies that have been presented above can be explained in table 3.1 below.

Table Error! No text of specified style in document..1 Measurement Strategy

Strategy	Form of Research Questions	Control of Events	Focus on Contemporary Events
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how big	No	Yes
Archive Analysis	Who, what, where, how many, how big	No	Yes / No
Historical	How, why	No	No
Case Study	How, why	No	Yes

How is the relation between cost accuracy and cost planning standards based on Permen PU No. 22 Tahun 2018 on the scope of Design Development Work, Sitework, and Structures Work in the main stadium area? With this, we will answer the questions using archive analysis, questionnaires, and Structural Equation Model (SEM).

Research Process

There are several stages in this research, all of which are combined from several elements from the data obtained from Research Question (RQ) and from the legal understanding of Permpen PU No. 22 Tahun 2018. The initial stage in this research is to identify the background of the problem that causes this research to be carried out, then the next stage is to formulate the problem statement in the

Research Question (RQ) so that the objectives of this research can be achieved. Next, an analysis of previous literature is carried out which will be used as a support for the literature study that has been mentioned in Chapter 2. In the conduction of research, there must be a conceptual model in order to develop the system that will be produced, also to determine the research methodology used as a tool to find the final result of the research

Research Variable

The point of research variables is everything that is determined by the researcher to be studied and used to obtain information about it, then get a conclusion (Sugiyono, Metode Penelitian Kuantitatif, Kualitatif, dan R&D, 2009). The followings are the research variables from this study:

Table Error! No text of specified style in document..2 Research Variables

No	Problem Statement	Independent Variable (X)	Dependent Variable (Y)
1	Development of Cost Planning Standards for Design Development, Sitework, and Structure for Stadium Area Works in Stadium Area based on Permen	- Technical Specification Standard - Cost Percentage per Scope of Work - Standard / Non-standard	Improve cost accuracy

PU No. 22 Tahun 2018 to improve cost accuracy	Fee per Scope of Work • Cost per m2 • Cost per seat • Permen PU No 22 Tahun 2018
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Procedures

The procedure used as research strategies that have been determined for this research is archive analysis, surveys in the form of questionnaires, and validation from experts. The questionnaire will be used as a research instrument in this study. Data collection for the Research Question (RQ) is divided into several stages. Before conducting a pilot survey for the first questionnaire, an analysis of the archive from previous literature studies was carried out as materials in order to create the questionnaires. The first stage of data collection was carried out to find out what elements of standard and non-standard costs could have an influence cost accuracy in the cost planning for integrated design and build contract in the scope of Design Development, Sitework, and Structure Work in the stadium area by validating the contents onstrcuts through interviews and discussions with experts..

Data Analysis

After the data has been collected, the next phase is to do data analysis. Data analysis is conducted to determine whether or not the independent variables could affect the dependent variables. The results obtained from the data analysis will be compared with the temporary associative causal research hypothesis. According to (Santoso, 2000) statistical science is useful for making decisions on certain problems. In addition, statistics can

also be interpreted as activities carried out to collect data, summarize/present the data, analyze the data with certain methods, and interpret the result of the analysis. To ascertain the effect of planning standards on cost accuracy in state buildings, this research is extended by evaluating respondent questionnaire data using the SmartPLS tool after it has been analyzed using the SPSS tool.

Validity and Reliability

a) Validity Test Using SPSS

A study is included in the category of trustworthy and has good results when the instrument in the study is valid and reliable. The validity test will measure the accuracy of each research instrument. In this study, the product moment correlation test or Pearson correlation using SPSS will be used to measure the validity of an instrument. Firdaus (2009) states that Pearson Correlation will have a correlation coefficient value to measure the strength of a linear relationship between two variables (Wulandari, 2021). The result of the Pearson correlation test is the Pearson correlation value "r". According to Sudhana (2005), a statement instrument will be declared valid if it has a Pearson correlation r value greater than the r value contained in the r distribution table (Wulandari, 2021). This study uses a sample of 74 people so that the value of r table as a guideline for measuring the validity of the data is 0.229 at a significant level of 5%.

Table 4.6 Result of The Pearson Correlation Analysis

	Correlations	Total	Description
X1.1	Pearson Correlation	0.775**	Valid
	Sig. (2-tailed)	0.000	
X1.2	Pearson Correlation	0.816**	Valid
	Sig. (2-tailed)	0.000	
X1.3	Pearson Correlation	0.788**	Valid
	Sig. (2-tailed)	0.000	

X1.4	Pearson Correlation	0.798**	Valid
	Sig. (2-tailed)	0.000	
X1.5	Pearson Correlation	0.838**	Valid
	Sig. (2-tailed)	0.000	
X1.6	Pearson Correlation	0.874**	Valid
	Sig. (2-tailed)	0.000	
X2.1	Pearson Correlation	0.793**	Valid
	Sig. (2-tailed)	0.006	
X2.2	Pearson Correlation	0.769**	Valid
	Sig. (2-tailed)	0.000	
X2.3	Pearson Correlation	0.814**	Valid
	Sig. (2-tailed)	0.000	
X2.4	Pearson Correlation	0.781**	Valid
	Sig. (2-tailed)	0.000	
X3.1	Pearson Correlation	0.740**	Valid
	Sig. (2-tailed)	0.000	
X3.2	Pearson Correlation	0.832**	Valid
	Sig. (2-tailed)	0.000	
X3.3	Pearson Correlation	0.771**	Valid
	Sig. (2-tailed)	0.000	
X3.4	Pearson Correlation	0.721**	Valid
	Sig. (2-tailed)	0.000	
Y1.1	Pearson Correlation	0.768**	Valid
	Sig. (2-tailed)	0.000	
Y1.2	Pearson Correlation	0.839**	Valid
	Sig. (2-tailed)	0.000	
Y1.3	Pearson Correlation	0.805**	Valid
	Sig. (2-tailed)	0.000	
Y1.4	Pearson Correlation	0.797**	Valid
	Sig. (2-tailed)	0.000	
Y1.5	Pearson Correlation	0.762**	Valid
	Sig. (2-tailed)	0.000	

Reliability Test (Cronbach's Alpha) Using SPSS

Reliability test is conducted to measure whether a research result can be trusted or not. According to Singarimbun (1989), the reliability test aims to determine the level of consistency or reliability of measuring instruments in providing research results as indicated by the consistency and stability of respondents' answers to each question. The reliability test will be carried out with SPSS using the Cronbach's Alpha method with the following conditions (Wulandari, 2021):

- Cronbach's Alpha value $> 0.6 \rightarrow$ Reliable

- Cronbach's Alpha value $< 0.6 \rightarrow$ Unreliable

The results of the reliability test of 19 indicators are as follows:

Table 4.7 Results of Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
0.871	19

The results of the reliability test in Table 4.7 show that of the 19 indicators used in this study, the Cronbach alpha's value of $0.871 > 0.6$ means that all indicators in this study are reliable and trustworthy. The reliability of each indicator can also be known through the value

of Cronbach's Alpha if Item Deleted which is listed in the following table:

Data Adequacy Test Using SPSS

The data adequacy test in this study was conducted to determine that the amount of data used was sufficient to be used or not. The data adequacy test will be analyzed using the KMO & Bartlett's Test using SPSS with the following results:

Table 4.9 Calculation Result of KMO dan Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.844
Bartlett's Test of Sphericity	Approx. Chi-Square	795.777
	df	171
	Sig.	0.000

The results of the KMO & Bartlett's Test in Table 4.9 show that this study has a KMO value of $0.844 > 0.5$, so it can be concluded that the research sample obtained is sufficient to be used. The value of Bartlett's Test of Sphericity has a significance value of $0.000 < 0.05$, which means that there is a significant correlation between research variables so that it can be continued to the next stage of analysis.

IV. RESULT AND DISCUSSION

All the existing indicators (indicators after deletion) have a significant effect on the latent variable because each has a T-statistic value greater than 1.96 or a P-Value < 0.05 . Furthermore, the following is a table of path coefficient result from bootstrapping to see the significance of the relation between variables.

Table 4.1 Path Coefficient Table, Result of Bootstrapping

Relation	Original Sample (O)	T Statistics (O/STDEV)	P Values	Description
Non-standard Cost -> Cost Accuracy	0.541	3.891	0.000	Significant Impact
Standard Cost -> Cost Accuracy	-0.197	3.014	0.003	Significant Impact
Other Cost -> Cost Accuracy	0.339	2.404	0.017	Significant Impact

The results of the Path Coefficient in Table 4.17 show the X1 variable. Standard Cost, X2. Non Standard Costs and X3. Other Costs have a significant effect on Y1. Cost Accuracy because the T-Statistic value > 1.96 or P-Value value < 0.05 Standard costs (0.541) and other costs (0.339) have a positive path coefficient value which means that standard costs and other costs have a positive and significant effect on increasing accuracy cost. Meanwhile, non-standard costs (-0.197) have a negative path coefficient value, which means that non-standard costs have a negative and significant

effect on decreasing cost accuracy. Judging from the smallest p-value and the largest coefficient, the variables that have the most influence on cost accuracy are standard costs, other costs and the last is non-standard costs.

R Square

The value of R Square is the coefficient of determination which explains the further relationship between the independent variable and the dependent variable. The value of R Square ranges from 0 to 1. The value of R Square which is closer to 1 (one), the better.

Table 4.2 R Square Table, Result of Bootstrapping

	R Square	R Square Adjusted
Y1 - Akurasi Biaya	0.739	0.728

Table 4.18 shows that the R-square value of the cost accuracy variable is 0.739 which indicates that the cost estimation accuracy can be explained by standard costs, non-standard costs and other costs of 73.9% which are included in the moderate category. (Joe F Hair et al., 2011). While the remaining 26.1% can be explained by variables other than the variables used in this study.

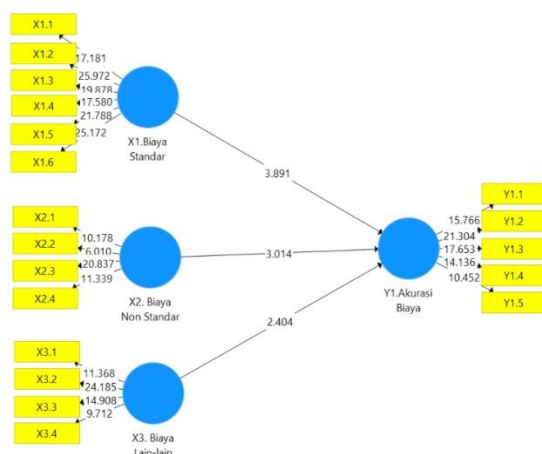
Fit Model

The result of Fit Model can be seen in table 4.3 below:

Table 4.3 Result of Fit Model

	Saturated Model	Estimated Model
SRMR	0.075	0.075
d_ULS	1.064	1.064
d_G	0.647	0.647
Chi-Square	247.130	247.130
NFI	0.720	0.720

Table 4.19 shows that the model in this study is able to represent the actual situation in the field by 72%. The following is a model of the relationship between variables in the Inner Model which is described using the SmartPLS software, which can be seen as follows:



Picture 4.1 Structural Equation Modelling
Overview on Inner Model

V. CONCLUSION

The mathematical model obtained from this research is $y = 0.541x_1 - 0.197x_2 + 0.339x_3$ so that the cost accuracy will improve if the standard and other costs are increased, while

non-standard cost must be reduced. This is also evident from the P-Value which shows that all the indicators are significant to cost accuracy.

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