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Analysis of Factors Affecting The Success of The Design And Build Contract On The Kediri Regency Stadium Construction Project

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ABSTRAK

Industri 4.0 merupakan suatu periode transformasi industri yang ditandai dengan adanya integrasi teknologi digital, otomasi, dan konektivitas data yang berdampak signifikan terhadap dunia konstruksi. Salah satu kemajuan dalam sistem kontrak konstruksi adalah penerapan kontrak rancang bangun yang bertujuan untuk meningkatkan kecepatan dan efisiensi kerja. Penelitian ini menganalisis faktor-faktor keberhasilan kontrak rancang bangun pada proyek pembangunan Stadion Kabupaten Kediri. Metode yang digunakan adalah analisis hasil kuesioner dan wawancara dengan pakar, serta model regresi linier berganda. Hasil penelitian menunjukkan bahwa faktor-faktor yang mempengaruhi tingkat keberhasilan proyek dapat diketahui melalui persamaan regresi Y = - 0,866 + 0,651X1 + 1,921X2 + 1,515X3 + 0,826X4 + 2,392X5 + 1,657X6, dengan nilai R kuadrat yang disesuaikan sebesar 0,957. Artinya faktor-faktor tersebut memiliki pengaruh sebesar 95,7% terhadap keberhasilan proyek. Penelitian ini menegaskan pentingnya kemampuan perencanaan yang baik dalam merancang dan membangun kontrak serta menyoroti peran penting koordinasi tim dan kejelasan tujuan proyek. Rekomendasi mencakup peningkatan fokus pada perencanaan yang komprehensif dan koordinasi yang lebih efektif antara tim yang terlibat dalam proyek. Penelitian ini diharapkan dapat memberikan wawasan kepada praktisi konstruksi dan manajer proyek tentang peningkatan efektivitas dan efisiensi proyek dengan menerapkan kontrak desain dan pembangunan.

ABSTRACT

Industry 4.0 is a period of industrial transformation characterised by the integration of digital technology, automation, and data connectivity, which significantly impacts the world of construction. One of the advances in the construction contract system is the application of design and build contracts, which aim to increase the speed and efficiency of work. This research analyses the success factors of design and building contracts in the Kediri Regency Stadium construction project. The method used is the analysis of the results of questionnaires and interviews with experts, as well as multiple linear regression models. The results showed that the factors that influence the level of project success can be identified through the regression equation Y = - 0.866 + 0.651X1 + 1.921X2 + 1.515X3 + 0.826X4 + 2.392X5 + 1.657X6, with an adjusted R squared value of 0.957. This means that these factors have an influence of 95.7% on project success. This research confirms the importance of good planning capabilities in designing and building contracts and highlights the critical role of team coordination and clarity of project objectives. Recommendations include an increased focus on comprehensive planning and more effective coordination between the teams involved in the project. This research is expected to provide construction practitioners and project

managers with insights on improving project effectiveness and efficiency by implementing design and build contracts.

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1. INTRODUCTION

Industry 4.0 is a period of industrial transformation characterised by the integration of digital technology, automation, and data connectivity. This involves technology that grows more complex over time, which also affects developments in the world of construction. Planning, organising, directing, and supervising labour resources in construction projects are done to meet short-term goals.

Planning aims to achieve the desired results. The contract between the project owner and the contractor determines the success of a construction project and serves as a reference for carrying it out. To ensure the project runs smoothly, both parties must study the contract articles carefully to avoid risks. [1].

Design-and-build, also known as design-and-build, is a procurement process between the project owner (owner) and the construction implementation team (contractor) to efficiently carry out the construction planning and execution process.

Article 1 point 1 [2] states the purchase of products and services by ministries, agencies, work units, or regional agencies is called government procurement, where the process begins with needs analysis and ends with the completion of the entire purchase of goods and services.

This research centres on the correlation between the design and build methodology and the success of the Kediri Regency Stadium project to determine the factors and influences between this method and the success of the Kediri Regency Stadium project.

2. METHOD

2.1 Validity Test

Seeks to assess how well the accuracy of the questionnaire based on respondents' answers can be measured in research, where the data is said to be valid if the calculated r value > the table r value.

2.2 Reliability Test

Aims to determine whether the factors in the study are reliable or not based on respondents' input. The high-reliability value uses the Cronbach Alpha value, and the reliability test results must be > 0.70.

2.3 Normality Test

The regression equation was used to measure data from independent and dependent variables. If the significance is > 0.05, it is said that the variable is normally distributed; if the significance is < 0.05, it is noted that the variable is not normally distributed

2.4 Normality Test

A scenario in a multiple linear regression model that indicates a relationship or substantial correlation between two or more predictor factors. This technique is used for two or more predictor factors.

2.5 Multicollinearity Test

A scenario in a multiple linear regression model that indicates a relationship or substantial correlation between two or more predictor factors. This technique is used for two or more predictor factors.

2.6 Heteroscedasticity Test

Tests whether the residual variance in the regression model is consistent across observations. If the significance is > 0.05, it is said that the variable does not show signs of heteroscedasticity. Conversely, if the importance is <0.05, it is noted that the variable shows heteroscedasticity.

2.7 Multiple Linear Regression

Linear regression models incorporate more than one predictor factor to estimate values for the intercept and slope using data involving multiple objects collected over some time.

2.8 THEORITUCAL REVIEW

2.8.1 Project Management

Management is the study of how to allocate limited resources and plan, coordinate, execute, and manage them to achieve organisational goals. The process and use of project management can be achieved by applying good management in every construction project.
Project management aims to organise construction work effectively and efficiently [3], and management functions can be managed optimally according to agreed requirements.

2.8.2 Construction Contract

A construction contract is an agreement that details the work to be completed, the cost and timeframe of the project, and other criteria related to the construction of the project. The contractor and the project owner sign it. Construction projects have distinctive characteristics, involve various resources, and require organisation [4]. For construction companies, cost control is very important. Planning aims to meet project specifications within the limits of cost, quality, and time [5].

2.8.3 Design And Build

Design and Build is a procurement method in which the project owner works with the construction team in one contract to carry out the design and construction processes efficiently

[6]. The design and construction process in the design and build method is simplified compared to conventional approaches such as design-bid-build, where the project contract specifically separates the implementation of design from construction. Design and build is a term that refers to contracts that include various work packages, comprehensive services, and project development and construction PMBOK® Guide, (2013).

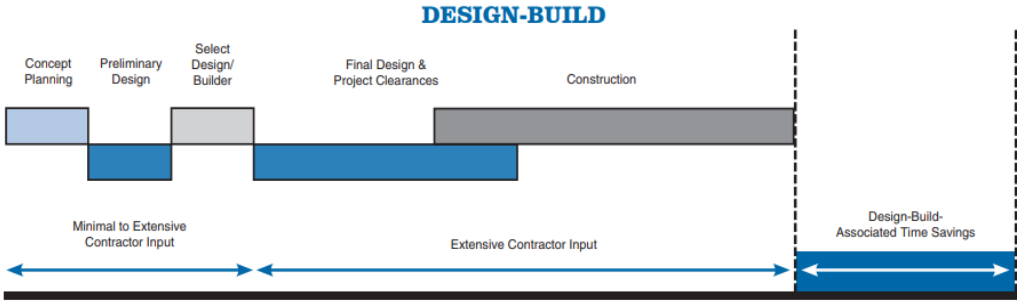

Figure 1. Stages of Implementation of the Design and Build Method

The stages of implementing the design and build method according to [8] are as follows:

1. Concept planning or design planning process.
2. Procurement or tender procurement process.
3. Design development or design development process.
4. Build or project construction process.
5. Monitoring and operational control of work implementation.
6. Closing or the process of completing project work

2.8.4 Factors of Project Succes in Design-and-Build Contracts

Factors that play a role in the occurrence of indicators in determining the success of a design and build project, according to [9], [10], [11] namely:

1. Project Owner Management Capability Factor (X1)
   a) A very tight construction schedule set by the project owner (X1.1)
   b) Unsystematic work plan planning (X1.2)
   c) Members of the project owner are willing to handle the work (X1.3)
   d) The project owner has planning experience in preparing the terms of reference (X1.4).
   e) The understanding of the project owner to determine the length of time for carrying out the design work (X1.5)
   f) The project owner is willing to provide input into work planning (X1.6).
   g) Assisting experts or construction management consultants will assist the project owner during project work (X1.7).
   h) The project owner can assess the design development results submitted by the contractor (X1.8).
   i) The quality of the project owner's communication with the planning team on design development (X1.9)
   j) Changes in work during implementation by the project owner (X1.10)

2. Planning capability factor (X2)
   a) Experience of the planning team in similar projects (X2.1)

b) The planning team's understanding of the project owner's requests for design needs (X2.2)
c) Understanding of applicable regulatory standards by the planning team (X2.3)
d) The planning team understands the duration of each project work activity (X2.4).
e) The planning team understands how to estimate the project cost budget (X2.5).
f) Communication between planning and implementation personnel of design and build work (X2.6)
g) The understanding of the planning team was that at the time of development design, there were design changes requested by the project owner (X2.7).
h) Delays in reaching design agreements caused by differences of opinion between the project owner and the planning team (X2.8)

3. Procurement Capability Factor (X3)
   a) Companies that have design and build project expertise (X3.1)
   b) The technical assessment requirements for the qualifications of bidders are not based on existing requirements (X3.2).
   c) Time for bidders to prepare an auction bid (X3.3)
   d) The design and build auction process has no standardised standards (X3.4).
   e) The time available for the project owner and tender committee to evaluate documents from design and build tender participants (X3.5).
   f) Delays in the stages of making contract documents (X3.6)
4. Implementation Ability Factor (X4)
   a) Contractor experience in working on design and build projects (X4.1)
   b) The contractor's ability to work on design and build projects (X4.2)
   c) The availability of equipment and machinery for contractors to carry out design and build work (X4.3)
   d) The contractor understands the design development that has been mutually agreed upon between the planning team and the project owner (X4.4).
   e) The contractor's ability in management capacity and quality control of design and build work (X4.5).
   f) The contractor is capable of project management such as human resources, safety, health, etc. (X4.6).
   g) Communication and coordination between parts of the contractor's organisation (X4.7)
   h) Subcontractors are negligent and slow (X4.8)
   i) Faulty design that leads to changes in the work (X4.9)
5. Project Manager Capability Factor (X5)
   a) Project manager experience in working on design and build (X5.1)
   b) Project manager experience in responsibility and division of tasks (X5.2)
   c) The manager's ability to make personal selections (X5.3)
   d) The project manager's experience with the work schedule (X5.4)
   e) The project manager's ability to delegate this project to the project owner (X5.5)
   f) The project manager can encourage the whole team to commit to the project's quality, cost, and time (X5.6).
   g) The project manager can coordinate and communicate with a group during the work (X5.7).

h) The project manager's ability to schedule monitoring and control meetings during the design phase (X5.8)

6. Project Scope Factor (X6)
   a) By the provisions of the design requirements (X6.1)
   b) Non-compliance of environmental conditions with initial planning (X6.2)
   c) The ability to understand the scope of work and the deliverables that must be produced (X6.3)
   d) Clarity in defining the project scope in the terms of reference (X6.4)
   e) The availability of adequate production units and equipment (X6.5)
   f) Changes in the political and economic policies or situations of the government (X6.6)
   g) Handling of environmental impacts (X6.7)

A project is successful when it can complete all tasks according to or even exceed the predetermined schedule, costs are reasonable and effective, and it achieves the expected quality. The success of a project is the main goal of every construction company.
According to [9], [12], [13] the parties involved in the project must understand the technical performance and standards used to achieve project success.

2.8.5 Project Success (Y)

a) Budget in accordance with the realisation in the field (Y1)
b) Time plan according to scheduling in accordance with field implementation (Y2)
c) Quality in accordance with the desired technical specifications (Y3)

2.8.6 Factor Analysis

A statistical approach often used in the design of measuring instruments is factor analysis, which assesses the relationship between several variables [14].
The purpose of factor analysis is to precisely describe the relationship between existing factors and assist in forming several understandings.

2.8.7 Multiple Linear Regression

Multiple linear regression analysis is a statistical approach that combines several predictor factors. The dependent factor of two or more predictor factors can be proven to have a large impact by utilising this regression. The more tests are carried out, the less the possibility of data errors. According to [15] the multiple regression model is:

$$Y' = a + b_1X_1 + b_2X_2 + \ldots\ldots + b_3X_3 + e$$

3. RESULTS AND DISCUSSION

3.1 Validity Test

The aim is to examine the success factors of the Kediri Regency Stadium Development Design and Build project. This test aims to measure the factors found in the questionnaire. The product-moment correlation formula was used on eight respondents, then the degree of freedom, or df = 8 - 2 = 6; $\propto$ = 5% (95% sig level, or alpha 0.05), then r_{tabel} is 0.7067. Table 1 below displays the results of the validity test.

Table 1. Result of Validity Testing

No	Indicator	r count	r table	Desc
1	X1.1	0,6616	0,7067	Invalid
2	X1.2	-0,5482	0,7067	Invalid
3	X1.3	0,8526	0,7067	Valid
4	X1.4	0,7758	0,7067	Valid
5	X1.5	0,8031	0,7067	Valid
6	X1.6	0,6364	0,7067	Invalid
7	X1.7	0,4497	0,7067	Invalid
8	X2.1	0,7480	0,7067	Valid
9	X2.2	0,8031	0,7067	Valid
10	X2.3	0,5857	0,7067	Invalid
11	X2.4	0,1809	0,7067	Invalid
12	X2.5	0,3518	0,7067	Invalid
13	X2.6	0,8074	0,7067	Valid
14	X2.7	0,8453	0,7067	Valid
15	X3.1	0,8457	0,7067	Valid
16	X3.2	0,7758	0,7067	Valid
17	X3.3	0,5978	0,7067	Invalid
18	X3.4	0,1734	0,7067	Invalid
19	X4.1	0,1225	0,7067	Invalid
20	X4.2	-0,0181	0,7067	Invalid
21	X4.3	0,9170	0,7067	Valid
22	X4.4	0,8178	0,7067	Valid
23	X4.5	0,0356	0,7067	Invalid
24	X5.1	0,8053	0,7067	Valid
25	X5.2	0,8212	0,7067	Valid
26	X5.3	0,6601	0,7067	Invalid
27	X5.4	0,7872	0,7067	Valid
28	X5.5	0,8576	0,7067	Valid
29	X5.6	0,4625	0,7067	Invalid
30	X6.1	0,6601	0,7067	Invalid
31	X6.2	0,8619	0,7067	Valid
32	X6.3	0,8208	0,7067	Valid
33	X6.4	0,2615	0,7067	Invalid
34	X6.5	0,5940	0,7067	Invalid
35	Y1	0,7856	0,7067	Valid
36	Y2	0,9078	0,7067	Valid
37	Y3	0,8340	0,7067	Valid

According to the findings of the validity test, the initial 37 indicators were reduced to 20 indicators that will be used for subsequent test analyses.

3.2 Reliability Test

With reliability testing, we can ensure that the data collected from research questionnaires that assess variables are reliable and consistent. Table 2 below displays the reliability test.

Table 2. Result of Reliability Testing

Questionnaire	Cronbach Alpha Coefficient	Description
All Indicators	0,940	Reliable

According to Table 2, it is known that all variables have a Cronbach alpha coefficient value of 0.940 > 0.70, so it is said that the indicators used to measure this questionnaire are consistent or reliable.

3.3 Normality Test

Software was used to conduct the Kolmogorov-Smirnov test to ascertain whether the residuals are normally distributed or not. Table 3 below displays the findings of the normality test.

Table 3. Normality Test Output

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		8
neters[a,b]	Mean	0.0000000
	Std. Deviation	0.00723937
Most Extreme Differe	Absolute	0.257
	Positive	0.168
	Negative	-0.257
Test Statistic		0.257
Asymp. Sig. (2-tailed)		.128[c]

The findings of the One-Sample Kolmogorov Smirnov Test, presented in Table 3 that the variables have a normal data distribution because the data produces Asymp. Sig 0.128 > 0.05.

3.4 Multicollinearity Test

Software was used to conduct the multicollinearity test to ensure whether there is multicollinearity among the variables. Table 4 below displays the findings of the multicollinearity test.

Table 4. Multicollinearity Test Output

Coefficients[a]								
Model				Standardized Coefficients	t	Sig.	Collinearity Statistics	
				Beta			Tolerance	VIF
1	(Constant)	-2.535	0.357		-7.105	0.089		
	X1	0.262	0.026	0.355	10.037	0.063	0.264	3.795
	X2	0.822	0.027	1.378	30.155	0.021	0.158	6.329
	X3	-1.160	0.047	-1.377	-24.870	0.026	0.108	9.288
	X4	0.511	0.043	0.446	12.011	0.053	0.239	4.180
	X5	-1.198	0.028	-2.128	-42.665	0.015	0.133	7.536
	X6	1.016	0.044	1.627	23.200	0.027	0.167	5.988

This multicollinearity test aims to examine whether there is a relationship between the predictor factors in the regression model. A tolerance value < 0.1 and a Variance Inflation Factor (VIF) > 10 indicate the presence of multicollinearity. Based on the results of the multicollinearity test using statistical software, the project owner's management capability (X1) has a Tolerance Value of 0.264 and a VIF of 3.795, the planning process (X2) has a Tolerance Value of 0.158 and a VIF of 6.329, the procurement process (X3) has a Tolerance Value of 0.108 and a VIF of 9.288, the executor's capability (X4) has a Tolerance Value of 0.239 and a VIF of 4.180, the project manager's capability (X5) has a Tolerance Value of 0.239 and a VIF of 7.536, and the project scope factor (X6) has a Tolerance Value of 0.167 and a VIF of 5.988.

From this, it can be concluded that the predictor factors X1, X2, X3, X4, X5, and X6 have Tolerance Values > 0.1 and Variance Inflation Factors (VIF) < 10, indicating that there is no multicollinearity or, in other words, there is no relationship or influence between the predictor factors.

3.5 Heteroscedasticity Test

Software was used to conduct the heteroscedasticity test to ensure whether there is heteroscedasticity among the variables. Table 5 below displays the results of the heteroscedasticity test.

Table 5. Heteroscedasticity Test Output

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.052	0.082		0.631	0.642
	X1	0.005	0.006	0.786	0.765	0.584
	X2	-0.001	0.006	-0.205	-0.154	0.903
	X3	0.000	0.011	-0.069	-0.043	0.973
	X4	-0.010	0.010	-1.054	-0.977	0.508
	X5	0.002	0.006	0.518	0.358	0.781
	X6	0.002	0.010	0.449	0.220	0.862
a. Dependent Variable: ABS_RES						

This test is conducted to ensure that the data being tested is homoscedastic and not heteroscedastic. If the correlation between the predictor fartors and their residuals yields a significance value greater than 0.05, it can be said that there is no heteroscedasticity problem. Based on the results of the heteroscedasticity test in Table 7, the predictor factors X1, X2, X3, X4, X5, and X6 have significant values greater than 0.05, indicating that there is no heteroscedasticity problem, meaning that the residual values tend to remain constant/similar across different values.

3.6 Multiple Linear Regression

Software was used in conducting multiple linear regression tests. Table 6 below displays the multiple linear regression findings from the analysis of Factors Affecting the Success of the Design and Build Contract on the Kediri Regency Stadium Construction Project.

Table 6. Multiple Linear Regression Result

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.866	0.085		-10.156	0.089
	Rata2_X1	0.651	0.044	0.379	14.784	0.063
	Rata2_X2	1.921	0.046	1.380	41.780	0.015
	Rata2_X3	-1.515	0.044	-1.352	-34.192	0.019
	Rata2_X4	0.826	0.051	0.434	16.145	0.053
	Rata2_X5	-2.392	0.040	-2.130	-59.440	0.011
	Rata2_X6	1.657	0.052	1.595	31.841	0.020
a. Dependent Variable: Rata2_Y						

The results obtained from Table 6 display a multiple linear regression model, namely Y = - 0.866 + 0.651X1 + 1.921X2 - 1.515X3 + 0.826X4 - 2.392X5 + 1.657X6. It indicates that

the most dominant factor is the X2 variable, namely the planning ability factor, with a value of 1.921. Table 7 below displays the results of the coefficient of determination.

Table 7. Results of the Coefficient of Determination

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.984[a]	0.968	0.957	0.08022	3.169
a. Predictors: (Constant), Rata2_X6, Rata2_X4, Rata2_X1, Rata2_X5, Rata2_X2, Rata2_X3					
b. Dependent Variable: Rata2_Y					

Table 7 displays the results of Adjusted R Square = 0.957. It is concluded that the success of the design and build of the Kediri Regency Stadium Development can be attributed to the project owner's management capabilities, planning capabilities, procurement process capabilities, implementation capabilities, project manager capabilities, and project scope factors, which together account for 95.7% of the overall project. Unknown factors determine the remaining 4.3% of project success. Table 8 shows the results of the f-test:

Table 8. F-Test Results

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.158	6	0.360	980.404	.024[b]
	Residual	0.000	1	0.000		
	Total	2.158	7			
a. Dependent Variable: Rata2_Y						
b. Predictors: (Constant), Rata2_X6, Rata2_X4, Rata2_X1, Rata2_X5, Rata2_X2,						

Software was used in the ANOVA test, resulting in a calculated F value and significance value for the effect of the project owner management capability variable (X1), planner capability (X2), procurement process capability (X3), implementation capability (X4), project manager capability (X5), and project scope factor (X6) simultaneously on project success (Y) of 0.024 <0.05.

5. CONCLUSION

The research results and discussion show the value of R square = 0.957. This shows the factors influencing the Kediri Regency Stadium Development Design and Build project have an influence of 95.7%, and the remaining 4.3% comes from sources outside the scope of this study.

The dominant factor influencing the success of the Kediri Regency Stadium Development Design and Build project shown in the regression equation Y = - 0.866 + 0.651X1 + 1.921X2 - 1.515X3 + 0.826X4 - 2.392X5 +1.657X6 is the project planning capability, which has an influence of 1.921 on project success. The better the project planning capability, the more the success of the Kediri Regency Stadium Development Design and Build project can increase.

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