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THE CONTRACT CHANGE ORDER ANLYSIS OF BRIDGE CONTRUSTION EMPLOYEES OF BIG HALL PROJECTS IMPLEMENTATION OF NATIONAL ROAD WHICH INFLUENCES THE TIME PERFORMANCE

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Abstract. *There is always problem of change order during the implementation of the project, either in first, middle, or the last project which involves the service user and the service provider. In every construction projects, there is always changing which called as change order (Jaydeep, et al, 2015). The change order could directly increase the cost of the project because of the additional material and volume, conflict of implementation schedule, rework, increase the overhead and increase the employees' fee (Hanna, et al, 1999). The aim of this research is to find the causative factors of change order and identify the dominant factors which cause the change order which influences the time performance of the national bridge project. The data collecting technique of this research used survey and the previous research. The analysis method that was used to find the dominant factors was Partial Least Square (PLS). There are 28 dominant factors the cause of change order which influences the time performance on national road project. From the 28 dominant factors, they will divide in to 3 factor groups.*

Keywords: causative factors, dominant factors, change order, national bridge project, Patial Least Square (PLS).

1. INTRODUCTION

In its implementation, a construction project is often faced with the problem of changing work orders at the beginning, middle or end of the project which involves both service users and service providers. These changes can be caused by planning having to change due to requests from service users for one reason or another or conditions in the field that do not allow carrying out work so that design changes are needed both in specifications and in the technical implementation stages. Every construction project often experiences changes which can be called change orders (Jaydeep et al. 2015)

Project construction is a process where design plans and specifications are converted into physical structures and facilities. This stage includes the organization and coordination of all project resources, namely labor, construction equipment, permanent and temporary materials, supplies and utilities, funds, technology, methods and time to be completed in accordance with project scheduling and budget targets, and standards. specifically by the planner.

Sandy et al. (2012) stated that it is rare in a construction project that no changes occur until the project is completed, but the large number of change order processes for a project is not recommended because it is more detrimental to the project itself.

Change Construct Orders change the details and conditions of work, which results in additional work (extra work) or reduction in work. A formal request to the service provider by the service user to carry out additional work because the service provider discovered errors (omissions) from the service user in their planning. The above can be referred to as construction changes (O'Brien & Zilly, 1991).

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Factors causing change orders can arise from various sources, namely project owners, consultants, contractors, subcontractors, natural factors, social factors, policies and others. The occurrence of change orders on construction projects can have direct and indirect negative impacts, both for service providers and service users. Directly, the impact caused by change orders is increased costs on the project due to additional volume and materials, implementation schedule conflicts, rework, increased overhead and increased labor costs (Hanna et al, 1999). Meanwhile, change orders can indirectly result in disputes between service providers and service users (Hanna et.al, 1999).

Back in 2019, the government, especially the Ministry of Public Works, was intensively carrying out equitable development projects, especially in the transportation sector, namely roads and bridges, and change orders would have a big impact if they were not properly anticipated regarding the negative impacts because change orders could be an obstacle during their implementation. This can cause the implementation schedule to increase or decrease, and greatly affect the project completion time, making it uncertain. According to Ibbs (1997) Of the 54 projects he studied, changes in work or change orders for construction projects could cause productivity levels to decrease. This will greatly affect construction activities, especially on bridge construction work on projects at the National Road Implementation Basar Center. This change will certainly have an impact on service users and service providers.

2. RESEARCH METHODS

In this research, the data collection method was obtained by distributing questionnaires. In conducting research, the data collected will be used to solve existing problems, so the data must be truly trustworthy and accurate. The data used in the research was obtained through the questionnaire method, namely a data collection technique carried out by giving a questionnaire or a set of questions or written statements to respondents (Sugiyono, 2005). In this questionnaire there will be a question design that is logically related to the research problem and each question is an answer that has meaning in testing the hypothesis.

1. Descriptive Statistics
   The descriptive statistical analysis used in this research is intended to provide an overview of the demographics of respondents which include gender, age, highest level of education, position and length of service which are disclosed to clarify the respondent's description.
2. Data Quality Test
   Data quality tests were carried out including reliability tests and validity tests using Partial Least Square (PLS) software. The reliability test is intended to measure the internal consistency of a questionnaire which is an indicator of a variable or construct. Reliability measurement was carried out using the Composite Reliability test ≥ 0.50 Ghozali (2008: 43). The validity test is used to measure whether a questionnaire is valid or not. A questionnaire is said to be valid if the questionnaire questions are able to reveal something that the questionnaire will measure. The validity test is carried out by comparing the square root of average variance extracted (AVE) value for each construct with the correlation between the construct and other constructs in the model. If the square root value of the AVE of each construct is greater than the correlation value between the other constructs in the model then each statement indicator is valid Ghozali (2008: 25).
3. *Structural Equation Modelling* (SEM) melalui *Partial Least Square* (PLS)
   Data collection was carried out using the Structural Equation Model (SEM) approach using Partial Least Square (PLS) software. PLS is a structural equation model (SEM) that is component or variance based *(variance)* Ghozali (2008:18). PLS is an alternative approach that shifts from a covariance-based to a variance-based SEM approach. Covariance-based SEM generally tests causality/theory while PLS is more of a predictive model. PLS is a powerful analytical method (1985) because it is not based on many assumptions. For example,

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the data does not have to be normally distributed, the sample does not have to be large. Besides being able to be used to confirm theories, PLS can also be used to explain whether there is a relationship between latent variables. PLS can simultaneously analyze constructs formed with reflexive and formative indicators. This cannot be done by covariance-based SEM because it would be an unidentified model.

The structural equation model is a multivariate analysis technique that allows researchers to test relationships between complex variables, both recursive and non-recursive, to obtain a comprehensive picture of the entire model.

3. RESULTS AND DISCUSSION

A. Uji Validitas

Testing the validity of the data in this research is by using smart PLS 3.0 software with the Outer Model, namely Convergent validity which is seen by the average variance extracted (AVE) value of each construct where the value must be greater than 0.5. Another way is to compare the square root of average variance extracted (√AVE) value for each construct (latent variable) with the correlation between the construct and other constructs in the model. If the square root value of AVE for each construct is greater than the correlation value between the construct and other constructs in the model, then it is said to have good discriminant validity values.

Table 1. ***Average Variance Extracted*** **(AVE)**

	Average variance extracted (AVE)	*√AVE*	**explanation**
Change Order	0,541	0,736	Valid
Construction execution	0,504	0,710	Valid
Pra-Construction	0,501	0,708	Valid

Table 2. ***Correlations of Latent Variables***

	CO	**Pel.Kons**	**Pra-Kons**
Change Order	0,736		
Construction execution	0,883	0,710	
Pra-Construction	0,753	0,742	0.705

Table 1. explains the value of AVE and the roots of AVE from the Pre-Construction, Construction Execution and Change Order constructs. It can be seen that each construct (variable) has an AVE value above 0.5. This shows that each construct has a good validity value for each indicator or the questionnaire used to determine the influence of Pre-construction, Construction Implementation, Change Order can be said to be valid. Another way that can be used to assess the validity of a construct is by comparing the root of the AVE which is in table 1. which is greater than the correlation of the latent variable, which is in Table 2. The results obtained state that the root of the AVE is greater when compared to the correlation latent variable, this can be interpreted as meaning that the statements in the questionnaire are declared valid.

B. Reliabilitas Test

Likewise with the reliability test, the author uses smart PLS 3.0 software with Composite Reliability. A data is said to be reliable if composite reliability is more than 0.7.

Table 3. ***Composite Reliability***

	Composite Reliability	**explanation**
Change Order	0,876	Reliabel
Construction execution	0,933	Reliabel
Pra-Construction	0,888	Reliabel

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From table 3, it can be seen that each construct or latent variable has a composite reliability value above 0.7, which indicates that the internal consistency of the independent variables (Pre-Construction, Construction Implementation) and the dependent variable (Change Order) have good reliability.

C. Data analysis

Measurement Model

In assessing the Outer Model in PLS, there are three criteria, one of which is looking at Convergent Validity while the other two criteria, namely Discriminant Validity in the form of square root of average variance extracted (AVE) and Composite Reliability have been discussed previously during data quality testing.

For convergent validity, the measurement model with reflexive indicators is assessed based on the correlation between item scores/component scores estimated with SmartPLS 3.0 software. An individual reflexive measure is said to be high if it correlates more than 0.7 with the construct (latent variable) being measured. However, according to Chin in Ghozali (2008; 24), For research in the early stages of development, a measurement scale loading value of 0.7 is considered sufficient.

Below you can see the overall correlation of each variable in Figure 1, namely the image which shows the direct influence of Change Orders on Pre-Construction, and the direct influence of Change Orders on Construction Execution. Where the model in Figure 1 has been eliminated, this is because there is a construct correlation of less than 0.5 so that each variable meets the convergent validity criteria. In the next discussion, we will discuss the correlation relationship between each exogenous variable and the endogenous variable.

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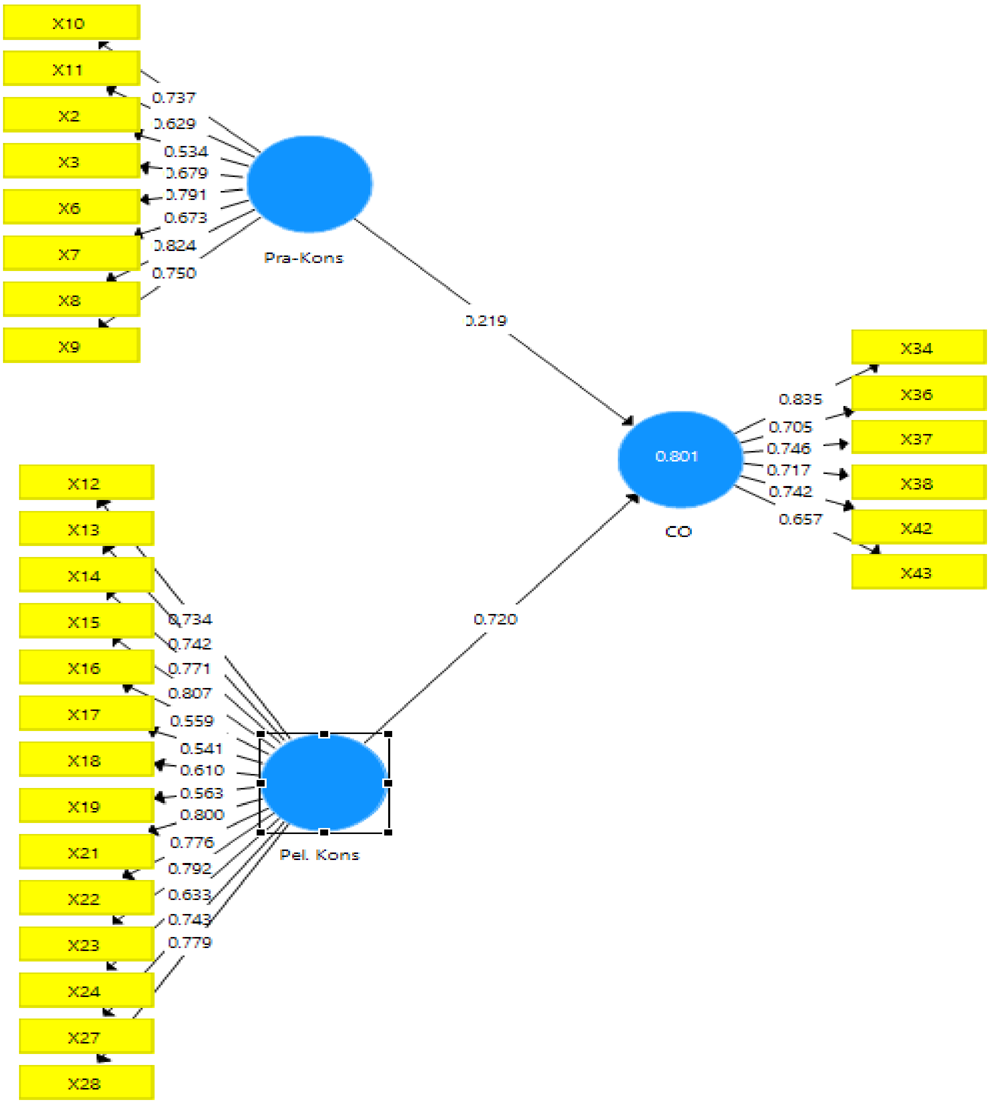

Figure 1. ***Full Model StructuralPartial Least Square***

Explanation

Pra-Cons	: Pra-Construction
Exe. Cons.	: Construction execution
CO	: *Change Order*

Outer Model **Variable Pra-Construction**

Pre-Construction variables are explained by X1 to X11. The outer loading test aims to see the correlation between the item or indicator score and the construct score. An indicator is considered reliable if it has a correlation value above 0.7. However, in the development stage, a correlation of 0.5 is still acceptable (Ghozali, 2008; 24).

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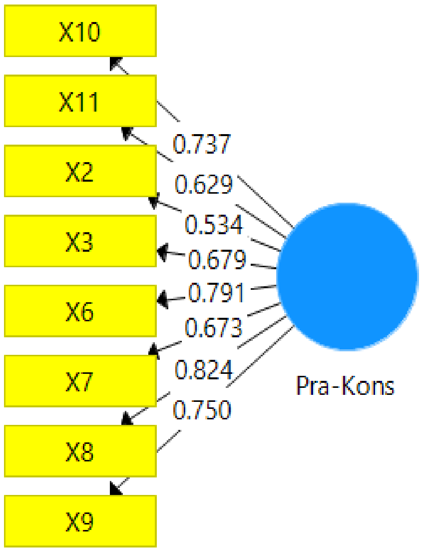

Figure 2. ***Outer Loadings (Measurement Model)*** **Variabel Pra-Construction**

Table 4. Mark ***Outer Loadings (Measurement Model)*** **Variabel Pra-Construction**

	original sample estimate	*mean of subsamples*	*Standard deviation*	*T-Statistic*
Pra - Cons				
X2	0,534	0,512	0,118	4,507
X3	0,679	0,661	0,098	6,964
X6	0,791	0,781	0,061	13,018
X7	0,673	0,657	0,096	7,039
X8	0,824	0,819	0,047	17,652
X9	0,750	0,756	0,044	17,160
X10	0,737	0,734	0.066	11,161
X11	0,629	0,635	0,092	6,835

The results of processing using SmartPLS 3.0 software can be seen in Figure 2 and Table 4, where the outer loadings values of the Pre-Construction variable indicators are. The final results after eliminating indicators below 0.5 show that there are no more indicators below 0.5 and show that the Outer Model value or correlation with the variables as a whole has met Convergent validity. As shown in figure VI.5. This can also be seen in table VI.11 where the T-statistic value for indicators X2 to X11 is greater than the T-table (1.96). So it can be concluded that the variable meets the model requirements or discriminant validity.

Outer Model **Variable Construction execution**

he Construction Implementation variable is explained by indicators consisting of X12 to X28. The outer loading test aims to see the correlation between the item or indicator score and the construct score.

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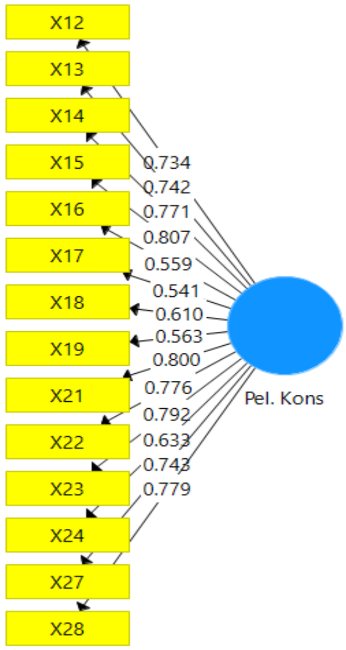

Figure 3. ***Outer Loadings (Measurement Model)*** **Variable Construction execution**

Table 5. Mark ***Outer Loadings (Measurement Model)*** **Variable Construction execution**

	original sample estimate	*mean of subsamples*	*Standard deviation*	*T-Statistic*
Pel. Kons				
X12	0,734	0,723	0,079	9,2800
X13	0,742	0,732	0,074	10,022
X14	0,771	0,773	0,049	15,866
X15	0,807	0,802	0,047	17,137
X16	0,559	0,560	0,088	6,380
X17	0,541	0,544	0,100	5,385
X18	0,610	0,609	0,085	7,163
X19	0,563	0,564	0,090	6,254
X21	0,800	0,798	0,048	16,658
X22	0,776	0,775	0,079	9,814
X23	0,792	0,790	0,080	9,957
X24	0,633	0,624	0,076	8,292
X27	0,743	0,743	0,049	15,215
X28	0,779	0,772	0,064	12,227

The results of processing using SmartPLS 3.0 software can be seen in Figure 3 and Table 5, where the outer loadings values of the Construction Implementation variable indicators are. The final results show that there are no more indicators below 0.5 and show that the Outer Model value or correlation with the variables as a whole meets convergent validity. As shown in Figure 3. This can also be seen in Table 3 where the T-statistic value for indicators X12 to X28 is greater than the T-table (1.96). So it can be concluded that the variable meets the model requirements or discriminant validity.

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Outer Model **Variable** ***Change Order***

The Organizational Commitment variable is explained by 6 indicators consisting of X34 to X43. The outer loading test aims to see the correlation between the item or indicator score and the construct score.

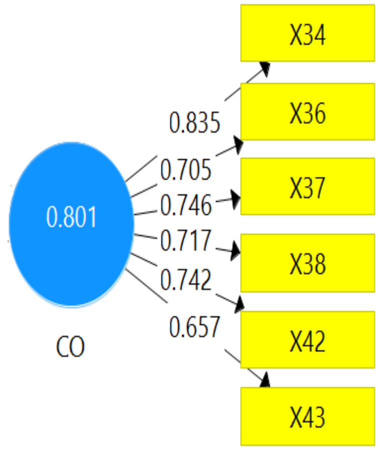

Figure 4. ***Outer Loadings (Measurement Model)*** **Variable** ***Change Order***

Table 6. Mark ***Outer Loadings (Measurement Model)*** **Variable** ***Change Order***

	original sample estimate	*mean of subsamples*	*Standard deviation*	*T-Statistic*	**P** *Value*
CO					
X34	0,835	0,830	0,055	15,049	0,000
X36	0,705	0,700	0,094	7,516	0,000
X37	0,746	0,740	0,079	9,421	0,000
X38	0,717	0,718	0,051	14,132	0,000
X42	0,742	0,743	0,051	14,524	0,000
X43	0,657	0,659	0,093	7,107	0,000

The results of processing using SmartPLS 3.0 software can be seen in figure 4 and table 6 where the outer loadings value of the Change Order variable indicator. Final results The final results after eliminating indicators below 0.5 show that there are no more indicators below 0.5 and show that the Outer Model value or correlation with the variables as a whole has met Convergent validity. As shown in Figure 4. This can also be seen in Table 5 where the T-statistic value for indicators 34 to X43 is greater than the T-table (1.96). So it can be concluded that the variable meets the model requirements or discriminant validity.

Hypothesis Testing According to the Inner Model

Inner model *according to Ghozali* (2008: 38) is a description of the relationship between latent variables based on substantive theory. Inner models are sometimes also called inner relations, structural models and substantive theory. In the model output results, it can be seen that the inner weight value of each direct or indirect relationship shows a value greater than 0, which indicates that the model has a predictive relevance value. The inner model in this research is as follows:

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Table 7. ***Result Of Inner Weights***

	Original sample estimate	*Mean of subsamples*	*Standard deviation*	*T-Statistic*	*Hipotesis*
Pel.Cons -> CO	0,720	0,712	0,062	11,701	Accept
Pra-Cons -> CO	0,219	0,230	0,063	3,496	Accept

In assessing the structural structure of the PLS model, it can be seen based on the R-Square value for each latent variable. The R-Square values in processing this research data are as follows:

Table 8. ***R-Square***

	R-square
Pra Construction	
Construction execution	
Change Order	0,801

Table 8 shows the R-square value of the Change Order construct of 0.801. The higher the R-square, the greater the independent variable can explain the dependent variable so the better the structural equation. The Change Order variable has an R-square value of 0.801, which means that 80.1% of the Change Order variance is explained by the Pre-Construction and Construction Implementation variables while the remainder is explained by other variables outside the variables examined in this research (Ghozali, 2008).

The significance of the estimated parameters provides very useful information about the relationship between the research variables. The limit for rejecting and accepting the proposed hypothesis is ±1.96, where if the statistical T value is greater than the T table (1.96) then the hypothesis is accepted, conversely if the statistical T value is smaller than the T table (1.96) then the hypothesis rejected (Ghozali, 2008).

D. Influence Testing Variable

1. Pra- Construction Influence on *Change Order*

Table 9. ***Result for Inner Weight***

	Original sample estimate	*Mean of subsamples*	*Standard deviation*	*T-Statistic*	*P Value*
Pra-Cons -> CO	0,219	0,231	0,059	3,713	0,000

Based on the processing of the data obtained, which is presented in table 9. Pre-Construction has a significant positive influence on Change Orders as shown by the original sample estimate value of 0.219 and the T-statistic of 3.713 (greater than the t-count, 1.96) and a P value of 0.000 (smaller than 0.005).

2. Construction execution Influence on *Change Order*

Table 10. ***Result for Inner Weight***

	Original sample estimate	*Mean of subsamples*	*Standard deviation*	*T-Statistic*	*P Value*
Pra-Kons -> CO	0,719	0,711	0,058	12,433	0,000

Based on the processing of the data obtained, which is presented in table 10. Construction implementation has a significant positive influence on Change Orders as shown by the original sample estimate value of 0.719 and the T-statistic of 12.433 (greater than the t-count, 1.96) and P Value 0.000 (smaller than 0.005).

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4. CONCLUSION

From the results of the Structural Equation Model (SEM) testing using SmartPLS as well as the discussions that have been carried out previously, it can be concluded that there are factors causing change orders that influence bridge construction work on the National Road Implementation Base Center projects, namely:

a. Based on the results of observations and discussions with experts, it was found that 43 factors cause change orders that influence time performance on national bridge projects.
b. After this was done, 28 independent variables were obtained that had an influence on change orders where the outer loadings value of each indicator was above 0.5. This shows that the Outer Model value or correlation with the variables as a whole meets Convergent validity or meets the model requirements or Discriminant validity
c. Pre-Construction has a significant positive influence on Change Orders as shown by the original sample estimate value of 0.219 and the T-statistic of 3.713 (greater than the t-count, 1.96) and the P value of 0.000 (smaller than 0.005).
d. Construction execution has a significant positive influence on Change Orders as shown by the original sample estimate value of 0.719 and the T-statistic of 12.433 (greater than the t-count, 1.96) and the P value of 0.000 (smaller than 0.005).
e. The R-square value of the Change Order construct is 0.801, so the independent variable can explain the dependent variable so that the structural equation is better

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