

**ANALYSIS OF CHANGE ORDER AND CAUSE FACTORS
THE INFLUENCE ON TIME COMPLETION OF COMPLETION
DEVELOPMENT OF SCHOOL X SCHOOL IN PROVINCE OF ISLANDS
BANGKA BELITUNG**

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Abstract:

Change orders occur during project implementation. Changes occur at the time of signing the employment contract. It is already done. X school building in the Islands Province Bangka Belitung was built with structural planning 8 floor, the first stage was built 4 floors. The purpose of this study is to analyze the factors causing change order and its effect on the project. This study examines various sources literature is a reference book that is relevant in 10 years lastly. The research methodology used is the research method quantitative. The results of this study were obtained 4 variables affect the completion time X school building construction which is the addition of scope jobs 58.9%, owner or representative owner performance 17.7%, insufficient 10% investment funds and cashflows not according to the actual progress of 2.9%. As well as expected results this analysis becomes a benchmark in the next project goes well.

Keywords: *change order, completion time, project, building, school*

I. Introduction

In every project implementation there is always a change that is commonly called a change order. Changes or change orders can occur at the initial stage of implementation, mid and until the completion of the project. The parties involved in the implementation project such as the owner or owner, contractor and external parties. The construction of school X buildings in the Bangka Belitung Islands Province was built by the owner or foundation, which was moved to expand education in Indonesia, to be able to contribute to the education sector that is beneficial in the area. Bangka Belitung Islands Province a province in Indonesia which consists of two main islands namely Bangka and Belitung islands and hundreds of smaller islands. Bangka Belitung is located in the eastern part of the island of Sumatra, close to South Sumatra Province. The capital of the province is Pangkal Pinang. School building X in the Bangka Belitung Islands Province was built in early December 2015 to June 2016. In July 2016 the school building was operational. School building X in the Province of the Bangka Belitung Islands was built with an 8-story structure plan, but the first stage was built 4 floors first. With an area of 2,968 m² of school land, and the area of each floor is 1,242.8 m². In the implementation of the construction of school X buildings in the Province of Bangka Belitung Islands there is a change order or changes in work on the

implementation of the project and its effect on the completion time of the construction of school buildings X.

Factors that cause change orders are design changes, acceleration of work schedules, addition of scope of work, incompatibility of images with field conditions, and so forth. The factors mentioned above are one of the factors that can influence the time of completion of the construction of school building X. So that it can cause delays in the completion of construction of school building X in the Bangka Belitung Islands Province. The construction of the school building X is through the planning stage that has been determined by the owner so that when the contractor has been chosen he can complete the construction on time and is contained in a work agreement or work order issued by the owner or owner to the contractor. According to Fisk (2006) the purpose of the change order is to change the contract plan that has been signed by both parties, namely the owner and the contractor to change the contract plan with the existence of a special method of payment. To change job specifications, including changes in payments and contract times from before. For approval of additional new work, in this case including payment and changes in the contract.

For administrative purposes, in determining the method of payment of extra work and additions. Following the adjustment to the contract unit price if there is a change in specifications. So these changes affect the completion time of the work. And the impact of change orders on each project implementation according to Barrie & Paulson (1992) the large impact that occurs from the change order made from the initial contract, namely: Small changes in the contract that is less than 10%, then the change can be tolerated and there is only an adjustment to time . When the change order has reached 15% of the initial contract value, it will affect the time and type of work very relative, depending on the contractor's management expertise to manage the change. When the change order reaches 20% of the initial contract value, this will greatly affect the contractor's performance on the project completion time.

Based on observations, and interviews of all parties involved in the X school building construction project, it is found that there are causes of change orders and their effects on the completion time, therefore it is necessary to study the completion of the X school building construction project in the Bangka Belitung Islands Province. Where is the construction management knowledge of this research regarding time schedule and risk management. The purpose of the implementation phase in this project is to be able to work in accordance with planning documents that are in accordance with the schedule and budget, if there are changes or differences in planning and implementation it is recommended to conduct an impact analysis on the type of work, time, quality and risk before the change is applied.

1.1 Research Problems

1. Is there an effect of change order on the time of completion of the X school building construction project in the Bangka Belitung Islands Province?
2. What are the factors and variables as well as the analysis of the discussion of the causes of change orders in the X school building construction project?

2. Literature Review

In this literature review, we will discuss theories related to research problems. The theoretical study discussed in this subject covers the construction process, the purpose of the change order, types of change orders, types of change orders, causes of change orders, impact of change orders and a portrait study of the construction of X school buildings in the Bangka Belitung Islands Province.

2.1 Construction Process

A construction project is an activity carried out with a specified time and resources with a limited time, where the construction activities are limited by the type of work, schedule and quality. In the project cycle or the project life cycle consists of 5 phases, namely:

1. Initiation Phase (Project Initiation)

This stage is the initial stage of project activities since a project is agreed to be carried out. At this stage, the problem to be solved will be identified.

2. Stage of Planning (Project Planning)

The planning stage is carried out to produce good work on time, the type of work that fits the budget and meets the desired quality.

3. Project Execution Stage

The purpose of the implementation phase in this project is to be able to work in accordance with planning documents that are in accordance with the schedule and budget, if there are changes or differences in planning and implementation it is recommended to conduct an impact analysis on the type of work, time, quality and risk before the change is applied. So that the process at this stage directs and manages project implementation towards completion, in accordance with existing planning documents.

4. Stage of Monitoring (Project Monitoring & Controlling)

Supervision Phase is to ensure that the project implementation can run well according to plans that have been made that relate to the time, type of work and quality. The process of monitoring and controlling is to control the changes that occur during the project, for this stage monitoring and reporting during project implementation using the progress of the work.

5. Final Stage (Project Closing)

The final stage is the stage of completing project work that has been done by conducting a final evaluation of the project and completion of payment administration to suppliers / vendors.

2.2 Purpose of Change Order

According to Fisk (2006) the purpose of the change order is:

1. To change the contract plan with a special method of payment.
2. To change job specifications, including changes in payments and contract times from before.
3. For approval of additional new work, in this case including payment and changes in the contract.
4. For administrative purposes, in determining the method of payment of extra work and its addition.
5. Following adjustments to the contract unit price if there is a change in specifications.

2.3 Types of Change Orders

1. Formal Change (Directive Change)

Is the proposed change in written form proposed by the owner or owner addressed to the contractor to change the scope of work, implementation time, costs or other things that are different from those specified in the contract document. In formal changes, it can give the owner the freedom to change the scope of work and require the contractor to follow the changes.

2. Constructive Changes

It is an informal action to authorize a modification of a contract that occurs in the field due to the request of the owner, planner or contractor. Constructive change as an agreement between the owner and contractor changes in cost, time. Changes in construction are often disputes between owners and contractors due to work outside the contract.

2.4 Causes of Change Orders

The cause of the change order there are many factors that occur during project implementation based on the parties involved in the project, namely:

1. Owner factors, namely:

- a. Design change
- b. Accelerate the work schedule
- c. Added scope of work
- d. Change in job location
- e. Delay in granting permits, approvals, and decisions
- f. Limited access in the field
- g. Insufficient investment funds
- h. Performance of owner or deputy owner
- i. Failure to provide site facilities, tools and materials
- j. Changes to work methods at the request of the owner
- k. Late payment
- l. Utilization of the project by the building owner before completion
- m. Prohibition of certain work methods
- n. Inspection process that is not in accordance with the contract
- o. Physical condition of the field
- p. Security and safety constraints
- q. Contractor problem
- r. Owner policy
- s. Errors / omissions in contract documentation

2. Planning Consultant Factors, namely:

- a. Planning and design mistakes
- b. Bestek image is unclear / incomplete
- c. Changes in specifications / changes in material and material quality
- d. Field conditions differ from the conditions stated in contract
- e. Underground conditions are different from the conditions listed in contract
- f. Added work
- g. Unrealistic schedule
- h. Inaccurate identification of planning data
- i. Change in scope of work
- 3. Contractor Factors, namely:
 - a. Changes to work methods
 - b. Subcontractor performance is not good
 - c. Incorrect implementation of work
 - d. Delay in execution of work
 - e. Delays in execution of work due to certain reasons
 - f. Volume estimation error
 - g. Cashflow that does not match actual progress
 - h. Delay in labor suppliers
 - i. Response to repair defects
 - j. Technological complexity
 - k. Low skill of workers
- 4. External factors, namely:
 - a. Third party intervention
 - b. Increase in material prices and labor costs
 - c. Socio-cultural condition of the community around the project
 - d. Central / local government policies issued after signing contracts that affect
 - e. Monetary policy
 - f. Labor disputes
 - g. Unexpected factors such as: floods, hurricanes, earthquakes, demonstrations and riot.

h. Changes to government policies / laws

2.5 Impact of Change Orders

Change orders in every project implementation cannot be avoided, including the impact of change orders. According to Barrie & Paulson (1992) the magnitude of the impact that occurs from change orders depends on the amount of change orders made from the initial contract.

1. A small change in the contract that is less than 10% then the change can be tolerated and there is only an adjustment in time.
2. When the change order has reached 15% of the initial contract value, it will have an impact on time and cost is very relative, depending on the expertise of the contractor management to manage these changes.
3. When the change order reaches 20% of the initial contract value, this will greatly affect the contractor's performance.

Change orders generally experience additional costs and time. Provisions regarding amendment to the contract are regulated in article 87 of Presidential Regulation number 54 of 2010 which reads:

1. Added work as referred to in paragraph (1) shall be carried out with the following provisions:

Not exceed 10% (ten percent) of the price stated in the initial agreement / contract, and availability of budget.

2. In the event that there are differences between field conditions at the time of implementation, with drawings and / or technical specifications specified in the contract documents, PPK together with the goods / service providers can make changes to the contract including:

1. Increase or decrease the volume of work that is stated in the contract.
2. Adding and / or reducing the type of work.
3. Change the technical specifications of the job according to field needs or change the implementation schedule.

2.6 Study of Portrait X School Building Construction in the Province of the Islands Bangka Belitung

School building X is a private school that was built in the Bangka Belitung Islands Province by the owner or the Foundation to be able to contribute in the field of education and can be felt by the local occupation in the Bangka Belitung Islands Province. The school building X has a national standard curriculum and has academic programs from Kindergarten-SD and up to junior high school. School X not only conducts teaching and learning activities at school to the students it teaches, but builds the character of these students to be better when out of school. The building data for the Bangka Belitung Islands Province school buildings are as follows:

Project Name: School X Bangka Belitung Islands Province

Address: Jl. Soekarno Hatta (d / h.Raya Koba) Kelurahan

Dul, Pangkalan Baru District Regency

Bangka Tengah, Province of Bangka Islands

Belitung 33684

School building X in the Bangka Belitung Islands Province was built with a structural plan for 8 floors, but as the first stage 4 floors were built first. With the total area of the school building which is 2,968 m², and the area of each floor is 1,242.8 m², each floor is made of classrooms from the 1st to the 1st floor rd floor, and 4th floor as multipurpose room and computer lab room. In addition to the class there are other supporting facilities at the X school. Some of the facilities contained in the X school building in the Bangka Belitung Islands Province are:

- Parking lots (motorbikes and cars)
- Lobby lift (ready, no lift)
- Lobby drop off
- Outdoor court (basketball)
- Indoor playground
- Main lobby
- 3 Kindy class rooms
- 1 Spare room
- Teacher lounge (include pantry)
- Library (senior / junior)
- Bookstore
- Server room
- Panel space
- Admin & finance room
- Admission room
- Locket finance
- Counselor room
- Health center room
- Canteen (3 tenants, capacity 96)
- Male kindy toilet
- Ladies' kindy toilet

- Male toilet
- Women's toilet
- Teacher's toilet
- Janitor, generator room, GWT room, emergency exit

On the 2nd floor, namely:

- Lobby elevator
- 8 classrooms (elementary - high school)
- Art room

Principal's room

- Vice principal's room
- POD area
- Male toilet
- Women's toilet
- Teacher's toilet
- Janitor and emergency exit

On the 3rd floor, namely:

- Lobby elevator
- 5 class rooms
- Music room
- Lab science
- Biology Lab
- Preparation lab
- Junior computer lab
- Spare room
- MPH (200 capacity)
- Men's toilets, women's toilets, teacher's toilets, janitors and emergency exits

4th floor namely:

- Lobby elevator
- 11 classrooms
- Computer lab

- Spare room
- Men, women's and teacher's toilets
- Janitor and emergency exit

Each kindy classroom has a capacity of 24 students per class while for junior / senior classrooms with a capacity of 30 students per class.

The definition of a change order is an official document signed by both parties to compensate the contractor for changes, additional work, delays or other consequences of the joint agreement

written in the contract. To change the contract plan with a special method of payment.

The purpose of the change order are:

1. To change job specifications, including changes in payments and contract times from before.
2. For approval of additional new work, in this case including payment and changes in the contract.
3. For administrative purposes, in determining the method of payment of extra work and additions.
4. Following the adjustment to the contract unit price if there is a change in specifications.

In the implementation of the construction of school buildings X the type of change order that exists in the construction of school buildings X is formal (Directive Change) that is the proposed changes in written form proposed by the owner or owner addressed to the contractor to change the scope of work, time of implementation, type of work- type of work or other things that are different from those specified in the contract document. In formal changes, it can give the owner unilateral freedom to change the scope of work and require the contractor to follow the changes. At the time of the construction of the school building X in the Bangka Belitung Islands Province change orders that occur in the field reached 17, 2% of the initial contract value, it will have an impact on the time and type of work very relative. For this project, the impact on completion time is delayed but the delay caused by the change order is insignificant and can still be tolerated by the owner or owner. Because contractor management can manage these changes well.

3. RESEARCH METHODOLOGY

This research method was carried out in the implementation of school building construction projects using quantitative methods. Research, questionnaire uestions are arranged in such a way as to make it easier for respondents to answer the questionnaire distributed to respondents directly involved in school construction. Questionnaire data analysis was performed on 35 respondents collected and inputted using the SPSS program. Of the 4 factors and 47 variables found in the factor analysis and the causes of change order and their effect on completion time in the X school building construction project in the Bangka Belitung Islands Province as follows:

After getting from 4 factors and 47 variables, the research was conducted by giving questionnaires based on their respective abilities and expertise

No	Variable Factor Table
	Owner
X1	Design changes
X2	Accelerate work schedule
X3	Added scope of work
X4	Change job location
X5	Delayin granting permission for approval and decision
X6	Limited acces in the field
X7	Insufficient investment funds
X8	Performance of owner or deputy owner
X9	Failure to provide site facilities, tools and materials
X10	Change of working method at the request of the power
X11	Late payments
X12	Utilization of the project by the building owner before project completion
X13	Prohibition of certain work methods
X14	The inspection process is not in accordance with the contract physical Condition of the field
X16	Security and safety constraints
X17	Contractor problems
X18	Owner policy
X19	Error/omissions in contract documentation
	Planning Consultant
X20	Planning and design errors
X21	The picture is not clear/incomplete
X22	Changes in specification/changes in material and material quality
X23	Field conditions differ from the conditions stated in the contract
X24	Underground conditions are different from conditions stated in the contract

X25	Added work
X26	Unrealistic schedule
X27	Identification of inaccurate planning data
X28	Change in scope of work
	Contractor
X29	Changes to work methods
X30	Subcontractor performance is not good
X31	Error performing work
X32	Delay in execution of work
X33	In execution of work for certain reasons
X34	Volume estimation error
X35	Cashflow that does not match actual progress
X36	Delay in labor suppliers
X37	Response to detective repairs
X38	Technology complexity
X39	Low skill of workers
	External
X40	Third party intervention
X41	Increase in material prices and labor costs
X42	Social-cultural conditions of the community around the project
X43	Central/local government policies issued after the signing of the contract affecting the project objectives costs
X44	Monetary policy
X45	Labor disputes
X46	Unexpected things such as: floods, hurricanes, earthquakes, demonstrations and riots
X47	Changes to government policies/laws

4. FINDING and DISCUSSION

In this study all influential variables will first be analyzed by correlation analysis.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.768 ^a	.589	.577	.39834	
2	.875 ^b	.766	.751	.30542	
3	.930 ^c	.866	.853	.23502	
4	.946 ^d	.895	.882	.21073	2.102

a. Predictors: (Constant), X3
b. Predictors: (Constant), X3, X8
c. Predictors: (Constant), X3, X8, X7
d. Predictors: (Constant), X3, X8, X7, X35
e. Dependent Variable: Y

Table: Summary Regression Analysis model

No	Dominant Variable	% Contribution to Y
X3	Adds work scope	58.9 %
X8	Performance owner or deputy owner	17.7%
X7	Insufficient investment funds	10%
X35	Cashflow that does not match actual progress	2.9%

From the table above, it can be explained as below:

Variable X3, namely the addition of scope of work can contribute to the increase in completion time by 58.9%. In the project implementation of the construction of school buildings X in the Province of Bangka Belitung Islands found the addition of scope of work is very influential on the completion of work on the school building construction project.

Additional scope of work occurs when the contract is signed between the owner and the contractor. The existence of this addition is because at the beginning a budget plan was made which was aimed at the owner or owner of the contractor and was not in the bid submitted by the contractor and only

receive design drawings from the planning planner at the beginning before the project starts. Along with the implementation of the project, there were several requests from the owner regarding the addition of work that did not yet exist in the initial contract of the work agreement, and there were design changes that caused additional work. So with the scope of the addition of work to the implementation of the construction of school buildings X in the Bangka Belitung Islands Province. Variable X3 additional scope of work, then this factor is the main factor of completion in the project implementation of the construction of school buildings X in the Bangka Belitung Islands Province.

Variable X8, namely the performance of the owner or representative of the owner has an important role in terms of the selection of the contractor who has been selected and the determination of the time to complete the construction of the project has been determined how long the project can be completed, the selection or determination of material specs. The time to complete the entire school construction work is determined by the performance of the owner or the owner's representative as

stated in the contractual agreement between the two parties signed between the owner and the contractor. Whereas spec material is released from the owner to the contractor. The role of the owner or deputy owner's performance is a factor that plays a role in the cause of change orders and their effect on the completion time in the implementation of the construction of school buildings X in the Bangka Belitung Islands Province. Variable X8 the performance of the owner or representative of the owner can contribute to the variable increase in the completion time of the construction of the X school building by 17.7%.

Variable X7, which is insufficient investment funds in the project implementation of the construction of school buildings X can contribute to the type of work construction of school X buildings by 10%. The investment fund of each project has been determined in value and will be used by the owner in managing the project during construction.

Variable X35 is cash flow that is not in accordance with the actual value in the field in the project planning process which also determines the project to be implemented. This can be felt both for the owner or contractor. The cash flow experienced by the owner or owner is when the monthly progress to be paid to the contractor is delayed due to cash flow that is not in accordance with the actual value in the field and the cash flow experienced by the contractor affects the purchase of materials, labor payments, mobilization of tools and things significant things that cause the influence of the cash flow during the implementation where the actual progress that is not appropriate in the project implementation of the construction of school buildings with a change or change order material procurement and unexpected costs during project implementation can contribute to the variable increase in pedan type increases the time completion of work at school X by 2.9%.

After going through a series of analysis and testing above, the results of research on the completion time of the project implementation of the construction of school X in the Province of Bangka Belitung Islands are obtained:

1. 1. X3 = addition of scope of work has an influence on the completion time of the construction of X school buildings by 58.9%.
2. 2. X8 = the performance of the owner or representative of the owner gives effect to the completion time of the construction of the X school building by 17.7%.
3. 3. X7 = insufficient investment funds have an influence on the completion time of the construction of school X by 10%.
4. 4. X35 = cash flow that is not in accordance with the actual progress has an influence on

5. CONCLUSION and RECOMMENDATION

1. School building X in the Bangka Belitung Islands Province was built with a structural plan for 8 floors, but as the first stage 4 floors were built first, when the construction underwent a change order after the contract was signed between the owner and the contractor. The addition of work takes place at the beginning, middle and end of the project which causes the completion time to be delayed but the delay that occurs is not too significant so that it can still be tolerated by the owner. Factors and variables examined in this study are factors taken from relevant literary studies.

2. There are 4 factors and 47 variables that cause change orders and their effects on the type of work in the implementation of a school building construction project X. Of these 47 variables after being tested by correlation, interrelation, multiple linear analysis and factor analysis, there are 4

main variables completion in the building construction project school X in the Bangka Belitung Islands Province. Scope of additional work is the most influential variable with the percentage affecting the completion time on the implementation of the school building construction project X 58.9%, then the performance of the owner or representative of the owner with a percentage of 17.7%, the third is insufficient investment funds with a percentage of 10%, and which Finally, cash flow is not in accordance with actual progress in the field with a percentage of 2.9%.

3. Work change orders of project need to be considered at the time of construction so the delays that occur in the field are not significant and the construction project can be done according to agreement between the owner and the contractor.

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