



# Time Management Application to Design-and-Build Construction of Integrated Cardiovascular Center Project at Jayapura Regional Hospital, Irian Jaya, Indonesia

Ihsanudin Andi Sukirno<sup>1\*</sup>, Nusa Sebayang<sup>2</sup>, Maranatha Wijayaningtyas<sup>3</sup>

<sup>1,2,3</sup> (Post Graduate Program of Civil Engineering, National Institute of Technology, Malang, Indonesia)

Corresponding Author: Ihsanudin Andi Sukirno

**ABSTRACT :** In the field of construction industry, an effective time management plays essential key to ensure the construction project finished according to the predetermined completion time. Identification of time management issues that arise in the construction project in the early stage able to reduce delay on a project time completion. In this study, researchers selected Integrated Cardiovascular Center construction project at Jayapura Regional Hospital as the object of the study with expectation of the project serves as one main example of Design-and-Build Construction management approach with aim to create advance facilities for fulfilling diverse demand from the local community as well as encourages sustainable development and environment awareness.

The purpose of this study is giving a proof of an effectiveness of Design-and-Build Construction management approach in a construction project by evaluating the Time Management Variable (X) influence to the Design Variable (Y) in Integrated Cardiovascular Center at Jayapura Regional Hospital. This research was carried out by employing a Slovin formula to total population of 70 respondents. Data collection method were employed questionnaire survey and a Likert scale 1-5 points before the research data tested by hypothesis tests: (a) Partial test/T-Test, (b) F statistical test, and (c) a multiple linear regression analysis.

The result of this study has found that time management variable obtained a calculated t value of 8.947 with significant result of  $0.001 < 0.05$  which interpreted to be a positive value of time management variable as influential factor in avoiding delay and ensure the project completion time runs on time. In a conclusion, within the context of the studied object, able to identify the most dominant factor that causes project delay becomes the important act to do in ensuring on-time project completion.

**KEYWORDS:** Time Management, Design and Build Method, Construction Project

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## I. INTRODUCTION

A project management is an integrated process where organization members participate in maintaining, creating, managing and executing programs with measured resources in an efficient, effective and timely manner to achieve the planned project (aimed at achieving predetermined goals and to continue with the schedule). There are three main task of management in general: to organize, to control and to plan. In addition, there also other important managerial functions such as setting an example, inspiring others, motivating others, giving direction and making decision (*decision making*) which also equally important. [1]

This project is one main example of Design-and-Build Construction Management approach, where it involves one contractor that held responsible for the construction and design of a project, simplifies work process and ensures a better coordination between so many stakeholders involved. For this project, the Integrated Cardiovascular Center Construction project at Jayapura Regional Hospital aims to create advanced facilities that able to meet diverse needs from the local community as well as to encourage sustainable development and environment awareness. [2]

Design-and-Build Construction management approach is selected for this project due to several reasons. First reasoning is to allow more efficient use of the resources because the contractor can focus on overall project goal without having coordination with multiple design firms and construction companies, while the second

reasoning is allowing contractor to be able in managing the project budget in better way as they can identify cost-saving measures and value engineering opportunities during the design phase. Aside from it, the Design-and-Build Construction Management method able to facilitate a faster project completion since there is no need for having a separate design and construction phase. [3]

In the construction phase, there are several key elements installed into the Integrated Cardiovascular Center such as energy-efficient systems, green roofs and use of local source materials. These features not only contribute to building's overall sustainability but also elevating sense of pride and ownership of the local community. This project also designs to be easy to adapt, allowing any future expansion and modification to meet the changing community needs. Hence, of entire project implementation to Integrated Cardiovascular Center construction project in Jayapura, Indonesia, it serves as a proof of the effectiveness of Design-and-Build Construction Management approach.

In the field of construction industry, an effective time management plays essential key to ensure within budget and on schedule project completion. No exception for the construction project of Integrated Cardiovascular Center at Jayapura Regional Hospital, where identifying time management issues in early stages can help reduce delays and cost overrun. Some common problems that may arise in this building construction project are poor planning, incorrect resource allocation, problem in communication detail, weather condition, regulatory approval, design changes and quality control problems.

In this research, the problem formulation is to seek which delay factors that has the most dominant influence in the Design-and-Build construction management of the Integrated Cardiovascular Center at Jayapura Regional Hospital.

## **II. LITERATURE REVIEW**

### **2.1. Time Management**

#### **2.1.1. Definition of Project**

A project is an activity or tasks that has been planned in prior time and to be completed within predetermined time which the cost also has been allocated. While Telaumbanua, defines management as a planned process involving coordination, managing, and supervising the use of organizational resources and the work of members of the organization. Siswanto emphasizes that estimating time required for completing this task is one of crucial initial step within the planning process in a project management, because it will serve as the basis of subsequent planning (for creating a work schedule, budget and workforce plans or organizing resources and controlling processes). [4,5,6]

In support with these theories, Heizer and Render stated that scheduling, planning and controlling become three important stages of project management during the planning stage. For specific target, the goal setting relates to project and team organization, while another step is arranging the design activities and connecting these to each other. At this moment, control stage will be in the hand of the company by oversees various resources, money and the work quality, and also for meeting expenses and deadlines, which sometimes the business also has change of plans or re-managing the return resources. [7]

### **2.2. Aspects of Time Management**

Operational planning and work scheduling according to predetermined time duration for the project becomes the basis of time management system. Here, the daily project tasks are managed based on scheduling, while the time management aspects are include a project planning and scheduling, assessing and reporting the status of each project task, comparing planned schedule with the actual work progress in the field, identifying impacts caused by this comparison at the end of the project, organizing corrective action to overcome these impacts, and as a final activity is updating the project schedule. Meanwhile, type of operations which made up the time management phase has a sequential character/orderly (Figure 1). [8]

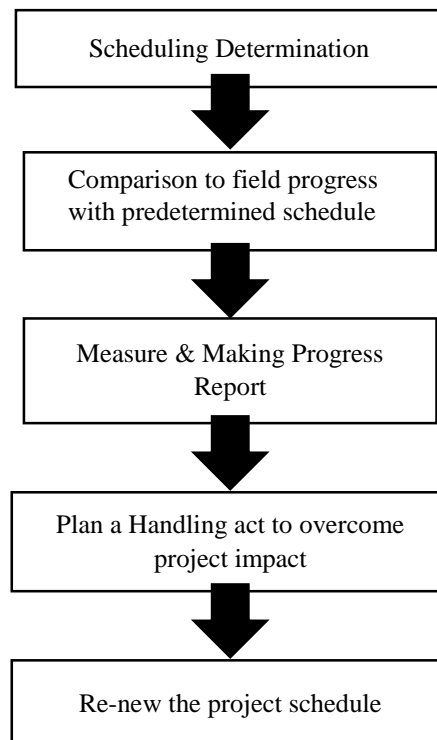


Figure 1. A System of time management in construction field

### 2.2.1. Identification of Activities (Structure of Task Detailing)

First step of project scheduling is determine the work activities. Each task is designed to facilitate work monitoring and to give an understanding about its implementation, to allow achievement of pre-defined project objectives within the scheduled time frame. Scope of the project then reorganized into a series of tasks according to the logic of dependency (work network) since the components of work then will be broken down into stages. There are several consideration when creating an activity schedule as listed below:

1. The existence of technological limitation related to construction technique, protocols and standards of work.
2. The existence of managerial limitation regarding time, money, quality and resources.
3. The existence of external obstacles such as bad weather, legal regulations and natural disasters.

### 2.2.2. Time Estimation of The Project

Each activity component is given a time estimation and required resources estimation for completing the activity once the network is established. Time required for completing all work becomes the definition of a project duration and the work volume, work/construction method, field condition, and the ability of the workforce to complete project work are influential factors for time estimation for completing the project work. [9]

### 2.2.3. Design-and-Build Construction Method

“Design” is a basic word to express idea of designing which mean organizing everything before the act, implement, or achieving something, or has meaning to plan something (according to KBBI/*Kamus Besar Bahasa Indonesia* or the Great Dictionary of Indonesia Language). Pressman also stated that design is a series of procedures for translating analysis results and systems into programming language as an effort to give detail description on how the system components are implemented. Pressman further stated that designing is an activity of translating result analysis into software package format and then creating system or gives improvement to the pre-existing system. [10]

Additionally, Maulani et al., define “design is creating and more creating in an application or non existing system in an agency or in an object”. Furthermore, Maulani et.al., emphasizes on “designing is creating and creating an application or system that does not yet exist in an institution or in an object”. Then, researcher came into conclusion that design is a description of a system which used to build a new system or update an old system based on the above definition. [11]

Design-and-Build construction method which also known as Design-Build is a project delivery method where there are one entity of design-build team that having responsible for both activities of design and also construction phases within a project. The design-build approach aims for simplifying delivery process by

integrating design and construction phases which later will result in a more efficient and more collaborative workflow [12]. The process of design-and-build approach involving these following steps:

1. Planning and Pre-design Stage

The first step of design-and-build construction process is planning and pre-design stage. During this phase, a group of project owner, consultant, and contractor work together to determine elements of work construction (the project scope, budget and schedule). Also, an identification was made to the project goal, objectives, and performance criteria. This collaborative action helps to ensure the construction project will fulfill the owner's demand and expectation.

2. Design Stage.

The second stage is a design stage where consultant and design team will develop detailed plans and specification for the project, and also include making architectural drawings, structural designs, mechanical, electrical and plumbing (MEP) designs, as well as preparing other required documents. The design team will work closely with contractor to guarantee that the construction design is buildable and able to meet the project performance criteria.

3. Construction Stage.

The third stage is a construction stage, where contractor and construction team held responsible for building the project according to the design and specification develop in the previous stages. It includes site preparation, excavation, foundation work, frame construction, also mechanical, electrical and plumbing installation, as well as the finishing work. The construction team will work closely with design team to make sure the project is built according to the approved design and able to meet the project workperformance criteria.

4. Post Construction Stage.

The final stage is post-construction stage that includes a completion of all remaining punch list items, along with final inspection and issuance of occupancy project certificate. Team of design and build also provides the project owner with operational and maintenance manuals as well as other necessary documentation to ensure a smooth operation of the ready facility.

Design-and-Build approach offers several advantages over the traditional bid-build method such as:

1. Cost Saving advantage

By integrating design and construction processes enables more efficient use of resources and resulted in a cost saving advantage for the project owner.

2. A faster completion project advantage.

A collaborative approach to design and build construction able to speed up the time for project completion since the design and construction teams are working side by side to identify and resolve the emerged problems.

3. Quality Improvement advantage

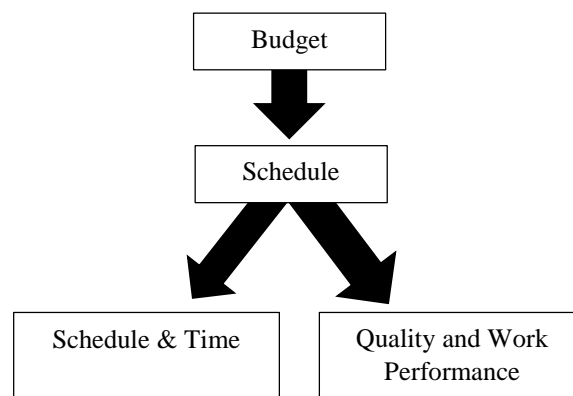
Since the design and construction processes is integrated, it allows better quality control because design and construction teams are working together in ensuring the project meets the demand and expectation from project owner.

4. Risk reduce advantage.

A single source responsibility as taken from the design team is reducing the risk over disputation and claims that may arise during the project.

### 2.3. Project Implementation

Project implementation is related to cost, time, and quality. Three mentioned elements here can be used to evaluate the success of a project. The level of project implementation is the satisfaction level from all parties involved within a project. [13]



**Figure 2.** Triple constraints [14]

According to Figure 2, the project target is three constraints of budget, schedule and quality. These constraints are explained as follows:

1. Budget  
The project budget must be completed at a cost that does not exceed the prepared budget. However, for type of project with large funds and has a multi-year working schedule, the project budget not only determined by total project but it will be broken down into components or sections, for example per period of time with the budget amount is adjusted to the field work necessities.
2. Schedule  
The project schedule must be established according to specified time period and the end date of the project completion. If the final product is in the form of a new product, then delivery time must not exceed the specified time limit.
3. Quality  
The quality of resulted products of the project activities must fulfill the required specification and predetermined criteria.

**Table 1.** Target and motivation of involved parties within a project

Project Target	Project Owner	Contractor	Consultant
Completion Schedule	Fast project completion to make the project result able to put in operational again.	Fast project completion, with minimum time is according to the contract date.	Fast project completion with minimum time is according to the contract date.
Project Cost	Establish price with the lowest value that is according to the engineering requirement and does not exceed the budget cost.	Gain profit as much as possible.	Gain profit as much as possible.
Quality in Project Works and Project Equipments	Functions (at least) to minimum expectation according to technical specifications and implementation method.	Fulfills the criteria and technical specifications as stated in the work contract.	Fulfills the criteria and technical specifications as stated in the work contract.

Liu and Walker in Rijaluddin describe three elements which able to determine the success of a project. First element is able to meet the project objectives which means the project able to be completed according to the budgeted cost, planned time and expected function or quality. The second element is the client satisfaction, and the third element is the client perception and awareness, where client have different views about the success of that project. [15]

### III. RESEARCH METHOD

#### 3.1. Research Object

The construction of Integrated Cardiovascular Center at Jayapura Regional Hospital is located in Soa Siu Dok Street, number II, Jayapura, Papua, Indonesia.

#### 3.2. Population and Sample of the Research

##### 3.2.1. Population

Population is a generalization area consisting of objects or subjects with certain quality and characteristics to be studied and determined by researchers to make them able to draw a conclusion. Research population of this study includes all related parties within the project such as main contractor, subcontractors, architects, civil engineers and the project managers. Since this study has large total population with a very limited time, the researcher is using a sample study (70) who have sufficient qualities and characteristics determined by the researcher and then draw a conclusion. For the population of this study, the researchers include all employees who work in companies in the Integrated Heart Building of Jayapura Regional Hospital and the researchers narrowed the population to 70 employees by calculating the sample size using the Slovin Technique. [16]

This study selected the Slovin formula because in effort of gathering 200-sample study, number must be representative so that research result able to be generalized where calculation will not require a sample number table, and can be done by using simple formula and calculation. The Slovin formula for determining sample is stated as follow:

$$n = \frac{N}{1+Ne^2} \dots \dots \dots (1)$$

Where:

- n = Sample Size / Number of Respondents
- N = Population Size
- e = Margin of Error ; e = 0,1

There is a provision which must be conform when using the Slovin formula where the value of e = 0.05 (5%) for large populations, so the sample range which able to be collected by Solvin technique is between 10 – 20 % of the research population.

Population of this study was 70 employees where the allowance percentage used was 10 % and calculation result could be rounded to achieve a suitability data. Based on the calculation above, sample of respondents in this study had an adjustment to 55 employees to make the data processing easier and gaining better test result.

**3.3. Identification of Research Variables**

**3.3.1. Dependent Variable**

A research variable known as dependent variable is one measured variable to ensure the effect strength or the influence of other variables exists. The dependent variable in this research is a design construction symbolized as (Y).

**3.3.2. Independent Variable**

Independent variable is a variable with variation whose its variation able to influence other variables. It sometimes referred as stimuli, predictor, and antecedent.

**3.4. Operational Variable**

Operational variable defines as related variable that connected to variables and formulated based on the conceptual nature of the properties from a variable, which able to be observed. This concept is made because research variables are a set of theoretical concepts related to the phenomenon being studied and has an abstract form and unable to be measured. The following table consist of explanation of the variables and operational definitions:

**Table 2.** Research variables and operational definition

No	Variable	Scale
1	Time Management (X)	1-5
<b>Indicators</b>	1. Able to set a goal. Setting a goal is the ability to set activity goals, which can be described into activities format. 2. Able to set a correct priority. Task have different characteristics of importance or urgency. 3. Able to prepare a project schedule. This ability ranging from activities related to time management (making list of works that must be done, making proper time allocation, and planning the rest time using a planner or other reminder tools). 4. Able to minimize any work disruption or interference, since it is unavoidable that almost everyone faces disruption in carrying out their activities. 5. Able to delegate tasks. Task delegation means giving some tasks and works to the ‘right individual’ with aims to increase work time efficiency and workperformance effectiveness.	
2	Design-and-Build (Y)	1-5
<b>Indicators</b>	1. Technical aspect regarding specification and quality of the structure being built. 2. Environmental aspect plays very important element in civil engineering design to ensure the project will not damage the ecosystem. 3. Social aspect focuses on the impact of the project to the surrounding community. 4. Economic aspect of Civil Engineering Design includes cost analysis and cost benefit of the project.	

**3.5. Data Collection Technique**

Data collection refers to the setting, sources and method of collecting data. The data collection technique in this research applied a questionnaire method. The types of surveys can be classified into two groups as response of how to answer questionnaires (open survey and closed survey). Therefore, the number of research instruments used in this study was taken based on the variables examined. In addition, Likert scale was selected to be used as the scale model in this research. [16]

A Likert scale is a research scale that designed to measure people’s attitude, perception and perspective on social issues. The social phenomenon selected for a study actually will be determined by researchers, whereas

the responses from the people to each instrument item using a Likert scale with be categorized into levels from very negative to very positive and put into a format as displayed in the table below. [17]

**Table 3.** Data collection by likert scale model

No	Criteria	Answer Category	Score
1	Strongly Agree ( <i>Sangat Setuju/SS</i> )	SS	1
2	Agree ( <i>Setuju/S</i> )	S	2
3	Neutral ( <i>Netral/N</i> )	N	3
4	Disagree ( <i>Tidak Setuju/TS</i> )	TS	4
5	Strongly Disagree ( <i>Sangat Tidak Setuju/STS</i> )	STS	5

### 3.6. Hypothesis Tests

#### 3.6.1. Partial Test (T Test)

T test in an individual partial regression coefficient test which employed to determine effect whether the independent variable able to influence the dependent variable individually. T test is basically held for testing the effect of each independent variable on the dependent variable [18,19]. Tesing in this assessment is executed using T count with T table according to steps listed below:

1. If T count is higher than 0.05 ( $T_{count} > 0.05$ ),  $H_0$  is accepted.
2. If T count is lesser than 0,05 ( $T_{count} < 0.05$ ),  $H_0$  is rejected.

#### 3.6.2. F Statistic Test

According to Kuncoro, F statistic test is used to assess in a simultaneous way the significant influence of the independent variable on the dependent variable. This test will be assisted by SPSS software application where the error or alpha significance level employed in this research was 0.05 (or  $\alpha = 5\%$ ) for gaining a hypothetical decision as stated in two categories below:

1. If the score of Tcount is higher than alpha (0.05), then  $H_0$  is accepted.
2. If the score of Tcount is less than alpha (0,05), then  $H_0$  is rejected.

## IV. RESULT AND DISCUSSION

### 4.1. Description of Research Object

Jayapura Regional General Hospital was built in 1956 by the Dutch East Indies government and inaugurated on June 5 1959. As conforming the analysis of type of medical service coverage according to the existing care ward layout, this hospital intended for wards of basic specialities (Internal Medicine Specialist, General Surgery Specialist, Obstetric and Content Specialist and Pediatric Specialist wards). Through time, since May 2, 1962, the West Irian was handed over to Indonesia Republic Government and as an effect, this hospital was also handed over to Indonesia until present time where today the management is carried out by the Papua Provincial Government. According to the lay out of the hospital building along with its historical record and be sorted according to time, the Jayapura Regional Hospital was categorized into type D status from 1962 to 1982, then in type C status from 1983 to 1994, and into Non-Educational type B status from 1995 to 2001 which finally from 2002 to present time, the Jayapura Regional Hospital is included into type B educational hospital.

### 4.2. Multiple Linear Regression Analysis

A multiple linear regression analysis was employed for determining the height of magnitude of independent variable in this study, namely the time management on construction design for Jayapura Integrated Cardiovascular Center. Then, data processing was held by the assistance of SPSS 22 and brought the following results:

**Table 4.** Result of multiple linear regression analysis

		Coefficients <sup>a</sup>				
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	19,344	2,162		8,947	,000
	Time Management	-,172	,108	-,190	-1,599	,115

Coefficients <sup>a</sup>			
Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Time Management	1,000	1,000

Dependent Variable: Design-and-Build Variable

Collinearity Diagnostics <sup>a</sup>					
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	Time Management
1	1	1,996	1,000	,00	,00
	2	,004	23,107	1,00	1,00

a. Dependent Variable: Design-and-Build Variable

### 4.3. Hypothesis Testing

#### 4.3.1. T Test

T test is used to perform a partial test to the significance relationship between X variable to the Y variable, or in brief, basically to show the extent or how far one independent variable (individually) able to explain variations from the dependent variables. As the output result from SPSS measurement is stated in the following tables:

**Table 5.** Result of T-Test

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	19,344	2,162		8,947	,000
	Time Management	-,172	,108	-,190	-1,599	,115

Table 5 is showing the hypothesis testing on time management. Based on the result calculation that have been carried out, it can be concluded that the calculated t value of 8.947 has a positive value with a significant result of  $0.001 < 0.05$ . This data result is interpreted as the time management on the construction project of Integrated Cardiovascular Center at Jayapura Regional Hospital can be improved and make the project completed on time.

#### 4.3.2. F Statistical Test (Model Feasibility Test)

F statistical test employed for determining whether all independent variables included in the model have a simultaneous influence on variables of leadership, work environment and work motivation to the employees' workperformance. Result of the F statistical test from SPSS is displayed on the following table (Table 6).

**Table 6.** Result of F-statistical test

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,242	1	6,242	2,556	,115b
	Residual	166,058	68	2,442		



Total	172,300	69			
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Table 6 is showing the result of model feasibility test has obtained F-count value of 172,300 with a significance level of 0.000 (0.05), meaning the research model used in this study is appropriate or feasible according to academical requirement.

**4.3.3. Coefficient of Determination**

Coefficient of determination ( $R^2$ ) is employed to test the magnitude of the independent variable influence has on the dependent variable, where the research data then processing with SPSS 22 program and brought the following result of:

**Tabel 7.** Coefficient of determination

Model Summary <sup>b</sup>					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,190 <sup>a</sup>	,036	,022	1,56270	2,178

According to Table 7, it showing the coefficient of determination test obtained result of 0.22 as the adjusted  $R^2$  value, which interpreted as 22.0 % of time management.

**4.4. Discussion**

This research is conducted with a purpose of taking Time Management variable (X1) influence to the Design variable (Y) at Jayapura Regional Hospital. The result of the most dominant delay factor in the Design-and-Build construction management in the object project (The Jayapura Integrated Cardiovascular Center Project) are explained in the following section:

In a construction project, project delay is a common problem encountered by the project team and can be caused by so many different factors. The researchers engaging a test of time management hypothesis based on the result calculation which had been performed and obtaining result of calculated T value of 8.947 as a positive value with a significant result of  $0,001 < 0.05$ . These calculated data can be interpreted as the time management variable in the Jayapura Integrated Heart Building construction project has been improved and the project will be completed on time. In the context of construction of this project, the important act is able to identify the most dominant factor that causes project delay, and this research is discussing several main factors which contributed to project delay as include:

1. Immature planning  
 Planning in a construction project is a crucial first step in construction management. When there is ambiguity in planning such as a lack of technical details or project specifications, it can cause confusion among stakeholders and contractors. An immature planning often resulted in unforeseen design changes during the construction phase which extending the completion time.
2. Human resources problem  
 Manpower or labor availability is very important factor for ensuring the smooth running of a project. When there is labor or skilled workers shortage or lack of working experience from the workers, it may cause delay in the implementation of certain tasks. Moreover, problem such as worker absenteeism also able to affect the progress of the project.
3. Delay in material procurement or material delivery time  
 Material procurement is an important aspect of construction management. Delays in material delivery from supplier can disrupt the overall construction process, which can be caused by many reasons such as logistic problem, bad weather, or errors in the material orders.
4. Regulation and permit changes  
 A construction project usually require permits from the local government or other relevant agencies. If there is a change in the existing regulation or if the permit not obtained in a timely manner, this could cause a significant delay in the project implementation.
5. Financial problem  
 Inadequate financing or late payments to contractor can also be a dominant factor in project delay. If the construction fund is not available in a timely manner, then work may have to be delayed until the fund is disbursed.

## V. CONCLUSION

In a construction project, delay is one common problem often encountered by construction doers and can be caused by various factors. In testing the time management hypothesis (based on the result of the completed calculation: calculated t-value of 8.947 as a positive value with a significant result of  $0,001 < 0,05$ ), these results can be interpreted as time management variable can help the construction project of Integrated Cardiovascular Center at Jayapura Regional Hospital to be completed on time (without delay). Within the context of construction project through studied object of Integrated Cardiovascular Center at Jayapura Regional Hospital, identifying the most dominant factor that causes project delay is the important act to do.

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