

Analysis of the Causes of Delays in Construction Projects at the XYZ Resort Bali Project

Ikhsan Setiawan, Rooslan Edy Santosa, Fredy Kurniawan, Nyoman Agus Sandika Purnaman

Department of Civil Engineering, Faculty of Engineering
Narotama University Surabaya, Jalan Arif Rahman Hakim 51, Surabaya
ikhsan.setiawan@narotama.ac.id, eddy.santosa@narotama.ac.id, fredy@narotama.ac.id,
agus_sp@pttj.com

Abstract

A construction project is a series of interrelated activities to achieve certain objectives (building or construction) within a certain time, cost and quality limitation. Delay in a project is a situation where the project cannot be completed within the planned time. The construction project at the XYZ Resort Bali project, in construction, occurred delays due to disputes. The disputes are caused by several factors between stakeholders, where each stakeholder has various and different problems. The purpose of this study is to identify and analyze the causative factors that contribute to delays in construction projects at the XYZ Resort Bali Project and provide suggestions or determine mitigation measures to overcome them. The method used is a quantitative approach in the form of literature studies, data collection through surveys, data analysis and conclusions. The survey questionnaire was designed based on the factors identified from previous research by determining as many as 6 aspects of the study with 45 types of causes or factors that contributed to project delays. Data analysis was carried out quantitatively descriptive of the delay factor variables from the questionnaire results. The questionnaire data was tested for validity and reliability, then analyzed using the fishbone diagram approach and the House of Risk method to determine the main factors that contribute to project delays and determine mitigation measures to overcome delays in project completion.

Keywords

Construction Projects, Delay Analysis, Resort Project Delays.

1. Introduction

Timely project completion is an efficient indicator of the construction industry. Construction time often serves as a benchmark for assessing project performance and the efficiency of the project organization. A project is said to be successful at completion on time. The time required to complete the construction of the project is often more than the time specified in the Contract. Apart from all the existing plans, the development process at the XYZ Resort Bali project is often disturbed by disputes that arise during the development process. So that it affects the time performance in project completion. This is a problem that must be found a solution. In addition, it is necessary to analyze the delay steps and how to mitigate the factors that cause the delay. The objective of this research is to identify the factors that cause delays that may arise in the construction project construction process at the XYZ Resort Bali project, and to analyze delays that may occur during project implementation, and determine effective mitigation measures to reduce the possibility of occurring delays.

2. Literature Review

According to Harold Kerzner (2009) in Remi (2017) it is stated that the Construction Project is a series of interrelated activities to achieve project objectives. In a construction project there are three important things that must be considered, namely time, cost and quality. According to Harold Kerzner (2009), it is stated that management usually has five functions or principles, namely: Planning, Organizing, Staffing, Controlling, and Directing.

Arditi, D. dan Patel (1989) in Proboyo Budiman (1999) stated, the main key to the success of implementing a project on time is complete and precise project planning and scheduling. Delays can be considered as a result of not fulfilling the planned schedule, because the actual conditions are not the same / in accordance with the conditions when the schedule was made. Kurniawan (2015) and Taurano and Hardjomuljadi (2013) stated that the dispute / dispute / Dispute stems from a conflict or incompatibility between the parties who will and are having a relationship or cooperation. Definition of tardiness according to Dewi (2019) that the work that has been targeted must be completed at a predetermined time but for some reason it cannot be fulfilled, it can be said that the work has been delayed.

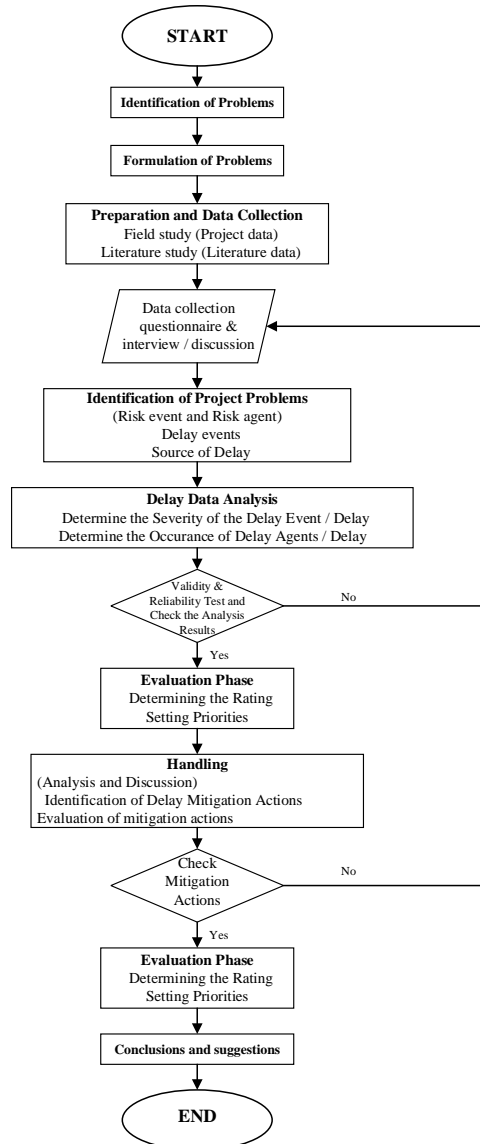
According to Kraiem and Diekmann (1989) and Proboyo Budiman (1999), it is stated that the causes of delays in project implementation time can be categorized into 3 major groups, namely: Delays that deserve compensation (Compensable Delay), Unforgivable delay (Non-Excusable Delay), and Excusable Delay. Several other previous studies regarding the factors causing delays in construction projects vary, especially the condition of each project has its own characteristics that are different from what has been done before.

According to Pujawan and Geraldin (2009), it is stated that risk is a function of the level of uncertainty and the impact of an event. The focus of risk management is to understand, and try to avoid, the devastating effects that a disaster or even the slightest disruption of a risk can have. The purpose of risk management is to reduce the likelihood of risk events occurring. In a construction project, a risk management is needed in order to be able to manage the project well because it is also part of the planning and control of a project.

Mario Coccia (2017) and Kusnadi (2011) stated that the Fishbone diagram (a fishbone diagram because it looks like a fishbone) is often called a Cause-and-Effect Diagram or Ishikawa Diagram introduced by Dr. Kaoru Ishikawa, a quality control expert from Japan, as one of the seven basic quality tools (7 basic quality tools). Fishbone diagrams are used to identify possible causes of problems. The House of Risk (HOR) method is a method for proactive risk management that focuses on preventive measures, where risk agents identified as the cause of risk events can be managed with proactive and effective steps to reduce the likelihood of risk agents occurring, so that risk events can be reduced or prevented. These proactive steps are carried out in accordance with the order of magnitude of the impact that may be caused. In Saputra and Baihaqi (2018), Emmanuel and Basuki (2019) developing this risk management model based on the idea that taking precautions against risk agents simultaneously can prevent one or more risk events by modifying the FMEA model (Failure Mode and Effect Analysis) for quantification of risk, adjusting the House of Quality (HOQ) model to prioritize risk agents, this idea is used to compile a framework for managing risk known as the House of Risk (HOR) approach. The HOR method approach is divided into 2 phases, namely HOR1 and HOR2, which in HOR1 is used to determine or identify risk agents to be given priority prevention, while HOR2 is a priority for effective treatment solutions in accordance with existing budgets and resources.

3. Research Methodology

The research methodology in this thesis is descriptive quantitative research, where the data is processed with a statistical approach and a description is given in the form of a description of a problem situation and the subject of discussion based on the grouping of an activity component or activity to obtain a systematic formulation of a problem. The quantitative approach used in this research is through the stages of literature study, data collection through questionnaire surveys, data analysis, interviews / discussions, evaluation and conclusions. By describing the facts and explaining the object of research in accordance with reality and trying to analyze it to provide the truth based on the data obtained in order to get the factors that cause delays in the construction project at the XYZ Resort Bali Project.



Flowchart 1. of Research Methodology Flowchart

4. Analisis and Discussion

4.1. Results of Data Collection

The population of this research is 37 personnel who are involved in the XYZ Resort project in 2020, which consist of 4 Owner / Deputy Owners, 27 Contractors, 4 Consultants, and 2 Subcontractors / Suppliers. By using the Slovin formula in sample calculations with a sampling error rate of 5%, are as follows:

$$n = \frac{37}{1 + 37(0,05)^2}$$

$$n = \frac{37}{1 + 37(0,05)^2} = \frac{37}{1,0925} = 33,8672$$

Adjusted by the researcher to 34 respondents.

Collecting data through a survey in the form of a survey questionnaire which was distributed to 35 people from the contractor / subcontract / supplier group, 7 from the consultant group and 3 from the project owner / owner representative group. Acceptance of respondents' answers, as many as 26 questionnaire answers were received from the contractor / subcontractor / supplier group, 6 answers from the consultant group and 2 questionnaire answers were received from the project owner / representative owner group. The rate of return of the questionnaire from the respondent contractor / subcontractor / supplier was 74.29%, the return rate of the questionnaire from the consultant respondents was 85.71% and the rate of return from the project owner respondents was 66.67% and the return rate of the questionnaire from all groups of respondents is 75.56%.

Table 1. Data Collection

No	Delay Factors	Frequency					Impact					% Highest Frequency (4&5)	% Highest Impact (4&5)
		1	2	3	4	5	1	2	3	4	5		
A	Planning & Scheduling Aspects												
1	Very strict project schedule setting by owner (Initial contract duration was too short)	0	6	13	14	1	0	5	6	14	9	44,12	67,65
2	Incomplete identification of the type of work that must exist	1	3	11	11	8	0	3	6	13	12	55,88	73,53
3	Work sequence plan that is not well structured / integrated (Contractor plans & schedules are not good & detailed)	2	5	12	6	9	0	3	6	17	8	44,12	73,53
4	Inaccurate determination of working time duration (Sequence of collision work scope)	1	5	16	8	4	0	5	12	12	5	35,29	50,00
5	The work plan of the owner that changes frequently (Addition to the scope of work of the owner / owner)	0	4	5	8	17	0	1	4	7	22	73,53	85,29
6	Wrong or inappropriate construction / work execution methods	3	9	10	6	6	1	5	7	12	9	35,29	61,76
B	Scope Aspects and Work Documents (contract)												
7	Planning (drawings / specifications) that are wrong / incomplete (incomplete / incomplete / incomplete data files / drawings)	0	6	7	13	8	0	2	7	13	12	61,76	73,53
8	Changes in design / work details at the time of execution	0	0	8	12	14	0	4	5	14	11	76,47	73,53
9	Change in the scope of work at the time of implementation	0	3	8	14	9	0	4	5	14	11	67,65	73,53
10	The process of making a working drawing by a contractor	1	5	16	9	3	1	6	10	12	5	35,29	50,00
11	Process of requesting and approving working drawings by owners	0	2	10	12	10	0	1	7	17	9	64,71	76,47
12	Disagreement with the rules for creating working drawings	2	8	19	2	3	1	8	15	6	4	14,71	29,41
13	There are many (often) added jobs (Re-negotiation of new rates & volume / remeasure)	0	1	4	15	14	0	3	3	9	19	85,29	82,35
14	There is a request for changes to work that has been completed	0	3	9	10	12	0	2	3	11	18	64,71	85,29
C	Aspects of Organizational, Coordination and Communication Systems												
15	Limited authority of owner personnel in decision making	0	5	8	13	8	0	3	9	10	12	61,76	64,71
16	Qualifications of personnel / owners who are not professional in their field	2	5	14	9	4	2	4	7	13	8	38,24	61,76
17	The owner's bureaucratic way of inspecting and controlling work	1	2	11	13	7	2	2	8	12	10	58,82	64,71
18	The failure of the owner to coordinate the work of many contractors / sub contractors	1	4	10	11	8	2	1	5	10	16	55,88	76,47

19	The failure of the owner to coordinate the transfer / use of land	3	6	12	5	8	2	5	7	6	14	38,24	58,82
20	Delays in supplying tools / materials etc. provided by the owner (SBO related delays)	1	1	8	10	14	0	2	3	8	21	70,59	85,29
21	Poor technical and managerial qualifications of personnel in the contractor's work organization (Poor site management and supervision by contractors)	1	9	8	14	2	0	5	3	19	7	47,06	76,47
22	Poor coordination and communication between parts of the contractor's work organization (Poor communication / coordination between parties (owner / contractor / consultant / supplier))	1	9	9	8	7	0	6	7	11	10	44,12	61,76
23	Occurrence of work accidents	7	12	10	4	1	4	12	10	5	3	14,71	23,53
D	Aspects of Readiness / Resource Preparation												
24	Slow mobilization of resources (materials, tools, labor)	2	7	12	8	5	0	3	6	14	11	38,24	73,53
25	Lack of skills and skills as well as work motivation of workers (workers are directly treaded)	1	12	6	11	4	0	6	8	13	7	44,12	58,82
26	The number of workers who are inadequate / in accordance with existing work activities	0	6	10	11	7	0	2	7	14	11	52,94	73,53
27	The unavailability of the material is quite certain / feasible as needed	1	9	11	6	7	0	6	3	16	9	38,24	73,53
28	Unavailability of work tools / equipment which are adequate / as needed	3	8	13	3	7	1	4	6	14	9	29,41	67,65
29	Negligence / tardiness by work sub contractors	0	4	11	13	6	0	3	3	18	10	55,88	82,35
30	Funding of project activities that are not well planned (difficulties in funding / financing in contractors)	3	5	10	11	5	2	3	3	15	11	47,06	76,47
31	Contractor is not paid properly according to his rights (difficulty in paying by the owner) / Duration of processing / delay of payment of owner / owner	0	2	7	15	10	0	2	2	12	18	73,53	88,24
E	Aspects of the Inspection, Control and Job Evaluation System												
32	Unscheduled submission of sample materials by contractors	3	10	14	5	2	4	4	11	12	3	20,59	44,12
33	The process of requesting and approving sample materials by the old owner (Duration of review approval process)	1	4	6	18	5	0	4	6	11	13	67,65	70,59
34	The process of testing and evaluating the material test of the owner is not relevant	2	8	12	10	2	2	2	11	14	5	35,29	55,88
35	The work permit approval process is lengthy (work delays due to failing to pass the checklist)	1	6	4	19	4	0	2	6	19	7	67,65	76,47
36	Failure of contractors to carry out work	2	16	6	5	5	2	7	7	11	7	29,41	52,94
37	Many work results that must be	0	8	16	5	5	0	6	6	15	7	29,41	64,71

	repaired / repeated because of defects / incorrect (errors in interpreting drawings or specifications)												
38	The process and procedures for evaluating the progress of work took a long time and passed an agreed schedule	0	10	10	11	3	0	3	12	13	6	41,18	55,88
F	Miscellaneous Aspects (Aspects beyond the capabilities of the Owner and Contractor)												
	Site conditions and environment turned out to be not as expected (Field measurements to determine position, points, lines and heights did not match the drawings / Inadequate data collection and surveys prior to design)												
39	Transportation to the project site is difficult (Difficult access for heavy equipment and project vehicles used during project implementation)	4	7	12	7	4	2	5	3	17	7	32,35	70,59
40	Unforeseen things such as fire, flood, storm / hurricane, earthquakes, landslides, very bad disabilities	5	7	11	10	1	5	3	11	11	4	32,35	44,12
41	There was a labor strike. (And personal conflicts between workers)	6	13	7	4	4	4	4	8	10	8	23,53	52,94
42	The existence of riots / riots, war	11	11	4	7	1	10	2	9	9	4	23,53	38,24
43	The occurrence of damage / damage due to negligence or actions of third parties	21	4	1	5	3	9	2	7	7	9	23,53	47,06
44	Changes in the government's political / economic situation or policies	13	7	8	4	2	5	6	8	10	5	17,65	44,12
45		11	9	7	5	2	5	6	11	6	6	20,59	35,29

4.2. Validity Test and Reliability Test

The results of the SPSS Test for the Validity of Variable X1 (Frequency), the respondent's data was N = 34:

		Correlations										
		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005	VAR00006	VAR00007	VAR00008	VAR00009	VAR00010	
X1_TotalSkor	Pearson Correlation	.494**	.528**	.528**	.626**	.695**	.750**	.671**	.386**	.569**	.362**	
	Sig. (2-tailed)	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.024	0.000	0.035	
	N	34	34	34	34	34	34	34	34	34	34	
		VAR00011	VAR00012	VAR00013	VAR00014	VAR00015	VAR00016	VAR00017	VAR00018	VAR00019	VAR00020	
X1_TotalSkor	Pearson Correlation	.577**	.577**	.476**	.673**	.641**	.663**	.546**	.686**	.794**	.607**	
	Sig. (2-tailed)	0.000	0.000	0.004	0.000	0.000	0.000	0.001	0.000	0.000	0.000	
	N	34	34	34	34	34	34	34	34	34	34	
		VAR00021	VAR00022	VAR00023	VAR00024	VAR00025	VAR00026	VAR00027	VAR00028	VAR00029	VAR00030	
X1_TotalSkor	Pearson Correlation	.618**	.663**	.460**	.761**	.686**	.677**	.800**	.842**	.674**	.583**	
	Sig. (2-tailed)	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	34	34	34	34	34	34	34	34	34	34	
		VAR00031	VAR00032	VAR00033	VAR00034	VAR00035	VAR00036	VAR00037	VAR00038	VAR00039	VAR00040	
X1_TotalSkor	Pearson Correlation	.754**	.654**	.679**	.703**	.658**	.676**	.578**	.671**	.824**	.543**	
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	
	N	34	34	34	34	34	34	34	34	34	34	
		VAR00041	VAR00042	VAR00043	VAR00044	VAR00045	X1_TotalSkor					
X1_TotalSkor	Pearson Correlation	.697**	.673**	.669**	.717**	.728**	1					
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000						
	N	34	34	34	34	34	34					

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 1. Correlations

The results of the SPSS Test for the Validity of Variable X2 (Impact), the respondent's data N = 34:

		Correlations									
		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005	VAR00006	VAR00007	VAR00008	VAR00009	VAR00010
X1_TotalSkor	Pearson Correlation	.658**	.364*	.404*	.560**	.499**	.560**	.524**	.421*	.421*	.477**
	Sig. (2-tailed)	0.000	0.034	0.018	0.001	0.003	0.001	0.001	0.013	0.013	0.004
	N	34	34	34	34	34	34	34	34	34	34
X1_TotalSkor	Pearson Correlation	.585**	.620**	.345*	.622**	.594**	.453*	.526**	.706**	.699**	.403*
	Sig. (2-tailed)	0.000	0.000	0.045	0.000	0.000	0.007	0.001	0.000	0.000	0.018
	N	34	34	34	34	34	34	34	34	34	34
X1_TotalSkor	Pearson Correlation	.601**	.629**	.459**	.795**	.529**	.746**	.826**	.770**	.703**	.736**
	Sig. (2-tailed)	0.000	0.000	0.006	0.000	0.001	0.000	0.000	0.000	0.000	0.000
	N	34	34	34	34	34	34	34	34	34	34
X1_TotalSkor	Pearson Correlation	.799**	.676**	.546**	.683**	.616**	.544**	.474**	.609**	.615**	.698**
	Sig. (2-tailed)	0.000	0.000	0.001	0.000	0.000	0.001	0.005	0.000	0.000	0.000
	N	34	34	34	34	34	34	34	34	34	34
X1_TotalSkor	Pearson Correlation	.501**	.584**	.552**	.543**	.689**	1				
	Sig. (2-tailed)	0.003	0.000	0.001	0.001	0.000					
	N	34	34	34	34	34	34				

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Figure 2. Correlations

Based on the table above, the results of the SPSS 25 output from each statement on variable x meet the requirements with 34 respondents. From these calculations, the results of the validity test for the variable x show that $r_{\text{Count}} > r_{\text{Table}}$, then the questionnaire is declared valid.

Results of SPSS Test of Variable Reliability X1 (Frequency), respondent data N = 34:

Table 2. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted
VAR00001	144.71	937.487	.474	.968
VAR00002	144.35	928.357	.503	.967
VAR00003	144.56	923.163	.499	.968
VAR00004	144.74	924.867	.607	.967
VAR00005	143.88	916.531	.676	.967
VAR00006	144.91	905.234	.731	.967
VAR00007	144.32	919.316	.652	.967
VAR00008	143.82	942.877	.364	.968
VAR00009	144.15	929.523	.549	.967
VAR00010	144.76	941.458	.336	.968
VAR00011	144.12	929.501	.557	.967
VAR00012	145.12	928.410	.556	.967
VAR00013	143.76	938.913	.456	.968
VAR00014	144.09	920.750	.655	.967
VAR00015	144.29	922.578	.621	.967
VAR00016	144.76	919.398	.644	.967
VAR00017	144.32	929.256	.523	.967
VAR00018	144.38	916.789	.667	.967
VAR00019	144.74	900.746	.778	.966
VAR00020	143.97	923.666	.585	.967
VAR00021	144.79	923.684	.598	.967
VAR00022	144.68	914.468	.641	.967
VAR00023	145.59	932.553	.433	.968
VAR00024	144.79	909.623	.745	.967
VAR00025	144.85	914.493	.666	.967
VAR00026	144.44	919.527	.659	.967
VAR00027	144.74	904.988	.786	.966
VAR00028	144.91	898.143	.830	.966
VAR00029	144.38	923.637	.658	.967
VAR00030	144.71	920.456	.557	.967
VAR00031	144.03	921.423	.741	.967
VAR00032	145.21	921.441	.635	.967
VAR00033	144.35	920.963	.662	.967
VAR00034	144.94	918.178	.686	.967
VAR00035	144.44	920.739	.639	.967
VAR00036	145.15	912.129	.654	.967
VAR00037	144.79	927.259	.556	.967
VAR00038	144.79	921.623	.653	.967
VAR00039	145.00	902.364	.812	.966
VAR00040	145.15	925.341	.517	.967
VAR00041	145.38	908.668	.675	.967
VAR00042	145.71	911.911	.651	.967
VAR00043	146.03	903.484	.642	.967
VAR00044	145.74	906.746	.697	.967
VAR00045	145.65	906.357	.708	.967

Table 3. Case Processing Summary

		N	%
Cases	Valid	34	100.0
	Excluded ^a	0	.0
	Total	34	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.968	45

Results of SPSS Test of Variable Reliability X2 (Impact), respondent data N = 34:

Table 4. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted
VAR00001	163.59	730.916	.637	.954
VAR00002	163.44	748.375	.334	.955
VAR00003	163.50	747.773	.377	.955
VAR00004	163.85	737.766	.536	.954
VAR00005	162.88	745.501	.477	.954
VAR00006	163.71	733.184	.531	.954
VAR00007	163.35	741.266	.499	.954
VAR00008	163.44	744.739	.391	.955
VAR00009	163.44	744.739	.391	.955
VAR00010	163.97	740.090	.447	.955
VAR00011	163.38	742.061	.566	.954
VAR00012	164.26	733.049	.597	.954
VAR00013	163.09	749.053	.314	.955
VAR00014	163.06	737.209	.602	.954
VAR00015	163.47	734.923	.569	.954
VAR00016	163.76	739.034	.419	.955
VAR00017	163.62	735.031	.496	.954
VAR00018	163.29	723.487	.684	.953
VAR00019	163.65	717.690	.673	.953
VAR00020	162.97	747.545	.376	.955
VAR00021	163.56	736.375	.579	.954
VAR00022	163.65	730.175	.604	.954
VAR00023	164.65	739.084	.426	.955
VAR00024	163.41	726.310	.782	.953
VAR00025	163.76	737.943	.502	.954
VAR00026	163.38	730.789	.731	.953
VAR00027	163.56	720.678	.813	.953
VAR00028	163.62	722.001	.753	.953
VAR00029	163.35	733.569	.686	.954
VAR00030	163.50	721.167	.716	.953
VAR00031	163.03	729.848	.787	.953
VAR00032	164.21	725.259	.653	.953
VAR00033	163.41	736.613	.519	.954
VAR00034	163.85	729.038	.663	.953
VAR00035	163.47	740.257	.598	.954
VAR00036	163.97	731.726	.512	.954
VAR00037	163.71	741.244	.445	.955
VAR00038	163.74	737.655	.588	.954
VAR00039	163.74	728.746	.589	.954
VAR00040	164.21	721.078	.674	.953
VAR00041	163.97	732.151	.464	.955
VAR00042	164.53	722.863	.549	.954
VAR00043	164.24	721.398	.511	.955
VAR00044	164.26	729.352	.509	.954
VAR00045	164.32	718.710	.663	.953

Table 5. Case Processing Summary

		N	%
Cases	Valid	34	100.0
	Excluded ^a	0	.0
	Total	34	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.955	45

Based on the results of the SPSS 25 output from each statement on variables X1 and X2, it fulfills the requirements with 34 respondents. From these calculations, the reliability test results for variables X1 and X2 show that the Cronbach Alpha value is ≥ 0.7 (namely 0.968 and 0.955). Then the reliability test results for variable X are declared reliable.

4.3. Fishbone Diagram and the House of Risk (HOR) Method

Table 6. The House of Risk (HOR) Method

Event Code	Risk / Event Delay	Highest Late Risk / Event	Severity
D1	Scope Aspects and Work Documents (contract)	There are many (often) added jobs (Re-negotiation of new rates & volume / remeasure)	5
D2	Planning & Scheduling Aspects	The work plan of the owner that changes frequently (Addition to the scope of work of the owner / owner)	5
D3	Aspects of Readiness / Resource Preparation	Contractor is not paid properly according to his rights (difficulty in paying by the owner) / Duration of processing / delay of payment of owner / owner	5
D4	Aspects of Organizational, Coordination and Communication Systems	Delays in supplying tools / materials etc. provided by the owner (SBO related delays)	5
D5	Aspects of the Inspection, Control and Job Evaluation System	Changes in design / work details at the time of execution	4

Fishbone Diagram - Factors Causing Delays in the XYZ Resort Bali Project

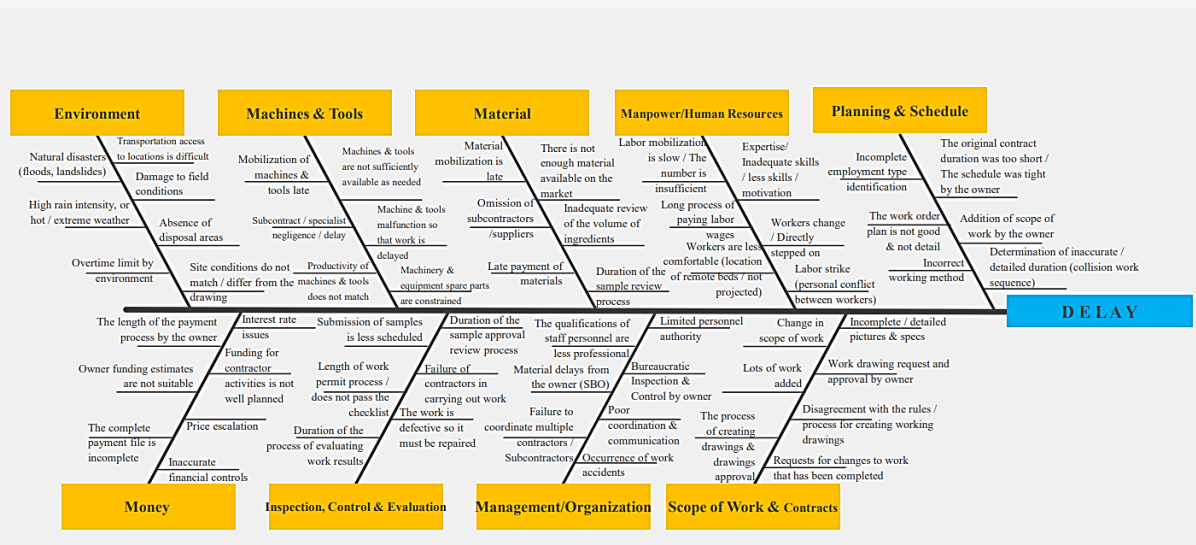


Figure 3. Fishbone Diagram

Table 7. The House of Risk (HOR) Method

Event Code	Risk / Delay Event	Agent Code	Risk / Delay Agent
D1	There are many (often) added jobs (Re-negotiation of new rates & volume / remeasure)	1D	Incomplete identification of the type of work
		2D	Changes / Additions to the scope of work
		3D	Planning drawings are less detailed than consultants
		4D	Sequence collision work scope
		5D	Poor communication / coordination between parties
D2	The work plan of the owner that changes frequently (Addition to the scope of work of the owner / owner)	1D	Incomplete identification of the type of work
		2D	Increase the scope of work
		3D	Planning drawings are less detailed than consultants
		5D	Poor communication / coordination between parties
		6D	Process of requesting and approving working drawings by owners
		7D	Long processing time / delay of payment from the owner
D3	Contractor is not paid properly according to his rights (difficulty in paying by the owner) / Duration of processing / delay of payment of owner / owner	8D	Incomplete data / image administration file
		9D	Length of time to process / delay of negotiation (Re-negotiation of new rate & volume / remeasure)
		10D	Unplanned funding
		7D	Long processing time / delay of payment from the owner
D4	Delays in supplying tools / materials etc. provided by the owner (SBO related delays)	10D	Funding is not well planned
		11D	Duration of the review approval process
		12D	Slow mobilization
		13D	Insufficient availability of materials (Lack of material stock in the market)
		14D	Negligence / tardiness by sub contractors
		2D	Increase the scope of work
		6D	Process of requesting and approving working drawings by owners
D5	Changes in design / work details at the time of execution	8D	Incomplete data / image administration file
		11D	Duration of the review approval process
		13D	Insufficient availability of materials (Lack of material stock in the market)
		15D	Inadequate / appropriate number of workers
		16D	Failure of contractors to carry out work
		17D	Results of work that must be repaired / repeated because of defects / incorrect (errors in interpreting drawings or specifications)
		6D	Process of requesting and approving working drawings by owners
		8D	Incomplete data / image administration file

Table 8. of Calculation ADPij (HOR1)

No	Risk/ Delay Event (E _i)	Risk/Delay Agents (A _j)																	Severity of Risk/Delay Event i (S _i)
		1D	2D	3D	4D	5D	6D	7D	8D	9D	10D	11D	12D	13D	14D	15D	16D	17D	
1	D1	9	9	9	3	1	9	3	3	9	3	3	0	0	0	0	0	0	5
2	D2	3	9	9	0	3	9	3	3	1	3	3	0	0	3	0	0	0	5
3	D3	0	9	3	3	3	0	9	9	9	3	3	0	0	0	3	3	3	5
4	D4	1	3	3	0	3	1	9	1	3	3	3	9	3	3	0	3	0	5
5	D5	3	3	9	3	3	1	0	9	0	0	9	1	1	9	9	9	9	4
	Occurrence of agent j	4	5	4	3	3	4	4	4	4	4	4	3	3	4	4	2	3	
	Aggregate Risk/Delay Potential j	308	810	624	126	186	396	480	464	440	240	384	147	57	264	204	132	153	
	Priority Rank of Agent j	8	1	2	16	12	6	3	4	5	10	7	14	17	9	11	15	13	

Table 9. of Percentage (%) Cumulative Pareto ADPj Chart

	Risk/Delay Agents (Aj)																	TOTAL ADPj
	2D	3D	7D	8D	9D	6D	11D	1D	14D	10D	15D	5D	17D	12D	16D	4D	13D	
Aggregate Risk/Delay Potential j	810	624	480	464	440	396	384	308	264	240	204	186	153	147	132	126	57	5415
Priority Rank of Agent j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Pareto Diagram	14,96%	11,52%	8,86%	8,57%	8,13%	7,31%	7,09%	5,69%	4,88%	4,43%	3,77%	3,43%	2,83%	2,71%	2,44%	2,33%	1,05%	100,00%
	14,96%	26,48%	35,35%	43,92%	52,04%	59,35%	66,45%	72,13%	77,01%	81,44%	85,21%	88,64%	91,47%	94,18%	96,62%	98,95%	100,00%	

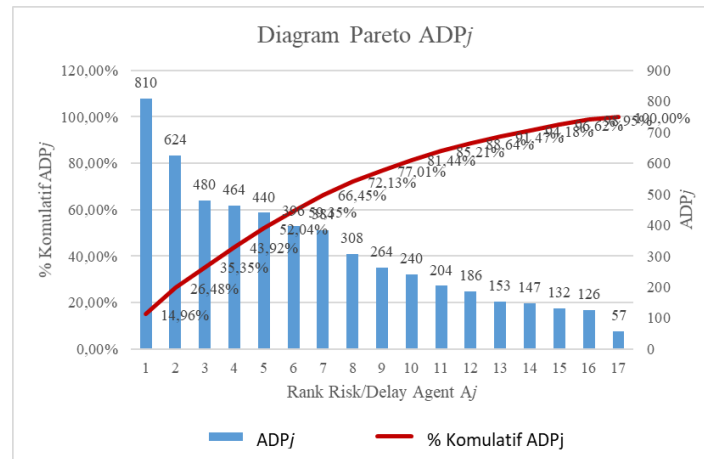


Figure 4. of Pareto Diagram ADPj

It can be seen from the Pareto diagram above that the main problem of delays in construction projects in the XYZ Resort Bali project is that it occurs based on ranking (in the top 10 rankings), including:

1. (2D) Change / Addition of work scope (14.96%).
2. (3D) Planning drawings are less detailed from consultants (11.52%).
3. (7D) The length of time to process / delay payment from the owner (8.86%).
4. (8D) The process of requesting and approving working drawings by the owner (8.57%).
5. (9D) Length of time to process / delay of negotiation (Negotiation of new rate & volume / remeasure) (8.13%).
6. (6D) The process of requesting and approving working drawings by the owner (7.31%).
7. (11D) Duration of the review approval process (7.09%).
8. (1D) Planning drawings are less detailed than consultants (5.69%).
9. (14D) Incomplete identification of the type of work (4.88%).
10. (10D) Funding was not well planned (4.43%).

Table 10. Agent of Delay

No	Agent of Delay	Mitigation Measures
1	Changes / Additions to the scope of work (2D)	<p>Make a check list of items against the new scope of work and adjustments to existing work items related to the addition of the scope of work.</p> <p>Completeness of data files related to additional scope of work (Site Instructions and drawings).</p> <p>Re-scheduling of new realistic rate & volume (remeasure).</p> <p>Make an outstanding list of drawings for request to consultants.</p>
2	Less detailed drawing planning from consultants (3D)	<p>Coordinate and review the condition of the existing drawings and the status of the shop drawing / composite drawing in relation to the type of work involved.</p> <p>Reviewing the boundaries of items & work areas so that work sequences can be coordinated with related parties (overlapping work scope areas).</p> <p>Create a realistic schedule for the owner's payment scheme</p> <p>Make an addendum to the contract regarding the imposition of late payment interest</p>
3	Process length / delay of owner payments (7D)	<p>Communicating and coordinating well and intensively with the owner</p> <p>Schedule adjustments to the priority scale against the scope of work</p> <p>Schedule for discussion of the completeness of the design (forcont design, specifications, and scope limitations of work items)</p>
4	Incomplete data / image administration files (8D)	<p>Adjustment back to the implementation schedule</p> <p>Perform good and intensive communication and coordination regarding the completeness of the data / image files, the length of the approval review process (sample & design changes)</p> <p>Scheduling of discussion of negotiation and priority scale of negotiation items.</p>
5	Length of time to process / delay of negotiation (renegotiation of new rate & volume / remeasure) (9D)	<p>Completeness of data / image files related to negotiated items.</p> <p>Ensure the price scheme of the Implementation Budget Plan and the negotiated price range.</p>

Table 11. Mitigation Measures

Code	Mitigation Measures	Degree of difficulty
PA1	Make a check list of items against the scope of new work and adjustments to existing work items related to additional work scopes.	5
PA2	Completeness of data files related to additional scope of work (Site Instructions and drawings).	4
PA3	Re-scheduling of new realistic rate & volume (remeasure).	4
PA4	Make an outstanding list of drawings to be requested from the consultant.	3
PA5	Coordinate and review the condition of the existing drawings and the status of the shop drawing / composite drawing in relation to the type of work involved.	3
PA6	Reviewing the boundaries of items and work areas so that work sequences can be coordinated with related parties (overlapping work scope areas).	4
PA7	Schedule a realistic owner payment scheme	5
PA8	Make an addendum to the contract regarding the imposition of late payment interest	4
PA9	Communicating and coordinating well and intensively with the owner	4
PA10	Schedule adjustments to the priority scale against the scope of work	4
PA11	Schedule a discussion of the completeness of the design (forcont design, specifications, and scope limitations of work items)	4
PA12	Adjustment back to the implementation schedule	5
PA13	Perform good and intensive communication and coordination regarding the completeness of the data / image files, the length of the approval review process (sample & design changes)	3
PA14	Schedule against discussion of negotiation and priority scale of negotiation items.	4
PA15	Completeness of data / image files related to negotiated items.	4
PA16	Ensure the RAP price scheme and the negotiated price range.	3

Table 12. of Mitigation Action Difficulty Scale

Scale	Description	Information
5	High	Factors that affect the level of difficulty include: Budget costs, human resources, materials, tools, time, procedures and others
4	Medium	
3	Low	

Table 13. of HOR2 Against the Top 5 Delay Agents

to be treated risk (delay) agent (Aj)	Preventive Action (PAk)																Aggregate Risk (Delay) Potentials (AR _{Pj}) atau (ADP _j)
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	PA11	PA12	PA13	PA14	PA15	PA16	
Change / Addition of scope of work (2D)	9	9	9	9	3	3	9	3	3	9	9	9	3	9	9	9	810
Less detailed drawing planning from consultants (3D)	9	9	3	9	9	3	0	0	3	3	9	9	3	3	3	1	624
Duration of processing / delay of payment of owner (7D)	0	3	3	0	0	1	9	9	9	3	0	3	1	3	3	0	480
Incomplete data / image administration files (8D)	3	3	1	9	9	3	3	1	3	3	9	3	9	3	9	1	464
Length of time to process / delay negotiation (Re-negotiate new rate & volume / remeasure) (9D)	1	3	9	3	1	3	1	1	3	1	1	3	1	9	9	3	440
Total of effectiveness of action k	14738	17058	15026	18402	12662	7494	13442	7654	11334	12434	17522	17058	9398	15954	18738	9698	
Degree of difficulty performing action k	5	4	4	3	3	4	5	4	4	4	4	5	3	4	4	3	
Effectiveness to difficulty ratio	2947,6	4264,5	3756,5	6134	4220,67	1873,5	2688,4	1914	2833,5	3109	4381	3412	3132,67	3989	4685	3232,67	
Rank of Priority	12	4	7	1	5	16	14	15	13	11	3	8	10	6	2	9	

Table 14. of Percentage (%) Cumulative Pareto ETDk Chart

	Preventive Action (PAk)																TOTAL ETDk
	PA4	PA15	PA11	PA2	PA5	PA14	PA3	PA12	PA16	PA13	PA10	PA1	PA9	PA7	PA8	PA6	
Effectiveness to difficulty ratio	6134	4685	4381	4265	4221	3989	3757	3412	3233	3133	3109	2948	2834	2688	1914	1874	30211
Priority Rank of Preventif Action k	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Diagram Pareto	10,84%	8,28%	7,74%	7,54%	7,46%	7,05%	6,64%	6,03%	5,71%	5,54%	5,49%	5,21%	5,01%	4,75%	3,38%	3,31%	100,00%
	10,84%	19,12%	26,87%	34,41%	41,87%	48,92%	55,56%	61,59%	67,30%	72,84%	78,33%	83,54%	88,55%	93,31%	96,69%	100,00%	

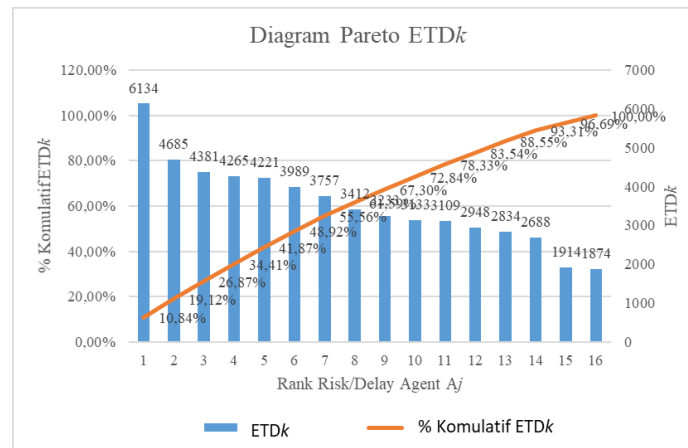


Figure 5. of Pareto Diagram ETDk

Table 15. Preventive Action (PAk)

Rank of Priority	Preventive Action (PAk)	
1	PA4	Make an outstanding list of drawings to be requested from the consultant.
2	PA15	Completeness of data / image files related to negotiated items.
3	PA11	Scheduling on the discussion of the completeness of the design (forcont design, specifications, and scope limitations of work items)
4	PA2	Completeness of data files related to additional scope of work (Site Instructions and drawings).
5	PA5	Coordinate and review the condition of the existing drawings and the status of the shop drawing / composite drawing in relation to the type of work involved.
6	PA14	Schedule against discussion of negotiation and priority scale of negotiation items.
7	PA3	Re-scheduling of new realistic rate & volume (remeasure).
8	PA12	Adjustment back to the implementation schedule
9	PA16	Ensure the RAP price scheme and the negotiated price range.
10	PA13	Perform good and intensive communication and coordination regarding the completeness of the data / image files, the length of the approval review process (sample & design changes)
11	PA10	Schedule adjustments to the priority scale against the scope of work
12	PA1	Make a check list of items against the scope of new work and adjustments to existing work items related to additional work scopes.
13	PA9	Communicating and coordinating well and intensively with the owner
14	PA7	Schedule a realistic owner payment scheme
15	PA8	Make an addendum to the contract regarding the imposition of late payment interest
16	PA6	Reviewing the boundaries of items and work areas so that work sequences can be coordinated with related parties (overlapping work scope areas).

Table 16. Achievement of Project Goals

Agent of Delay	Mitigation Measures	Achievement of Project Goals
Change / Addition of scope of work (2D)	Make an outstanding list of drawings to be requested from the consultant	TIME
Less detailed drawing planning from consultants (3D)	Completeness of data / image files related to negotiated items.	QUALITY
Length of processing time / delays of payment from the owner (7D)	Scheduling on the discussion of the completeness of the design (forcont design, specifications, and scope limitations of work items)	
Incomplete data / image administration files (8D)	Completeness of data files related to the addition of the scope of work (Site Instructions and drawings)	COST
Processing time/negotiation delays (Renegotiate new rate & volume/remeasure) (9D)	Coordinate and review the condition of the existing drawings and the status of the shop drawing / composite drawing in relation to the type of work involved	

5. Conclusions and Suggestions

5.1. Conclusions

From the research that has been done, the Fishbone diagram approach and the application of the House of Risk (HOR) method to analyze the risks / factors that cause delays to become events / incidents of delay in construction projects on the XYZ Resort Bali project get the following conclusions:

1. Factors causing delays, there are 17 (seventeen) risk factor agents, namely: Incomplete identification of the type of work, Changes / Additions to the scope of work, Planning for less detailed drawings from consultants, Squence of collision work scope, Poor communication / coordination between parties, Request process and approval of working drawings by the owner, length of time to process / delay of payment from the owner, file administration data / images are incomplete, length of time for processing / delay of negotiation (re-negotiation of new rates & volume / remeasure), funding is not well planned, length of review process approval, slow mobilization, insufficient material availability (lack of material stock in the market), negligence / delay by sub-contractors, inadequate / appropriate number of workers, failure of contractors to carry out work, and results of work that must be repaired / repeated due to defects / not true (Error in interpreting drawings or specifications). This resulted in 5 (five) incidents of delay identified by the research as the highest ranking, namely: There were many (often) added jobs (renegotiated new rates & volume / remeasure), Work plans of owners that often changed (Adding scope of work to owners / owners), The contractor is not paid properly according to his rights (difficulty in paying by the owner) / The length of the process / delay of payment of the owner / owner, the delay in the provision of tools / materials etc. provided by the owner (SBO related delays), and Changes in design / work details during implementation.
2. From the data analysis on the delay factor, it is found that the top five rankings of the agents of the factors causing the delay and mitigation action strategy steps for each of these delay agents are:
 - a. Make an outstanding list of drawings to be requested from the consultant. This will help the consultant to further coordinate with the planner so that the missing drawings can accelerate the process so that detailed shop drawings and composite drawings are carried out on related work items and project activities are not delayed.
 - b. Completeness of data / image files related to negotiated items. With a complete data / image file, of course the negotiation process will not be hampered and the completeness of the file attachments will make the process time faster and the detail checking of items and volumes is not constrained.

- c. Scheduling on the discussion of the completeness of the design (forcont design, specifications, and scope limitations of work items). By scheduling the completeness of the design, it will certainly make it easier to discuss between parties (architects / planners, other contractors, consultants) in the shop drawing and detailing process.
- d. Completeness of data files related to additional scope of work (Site Instructions and drawings). If changes and adjustments / additions to the scope of work occur, of course, complete data files such as site instructions, minutes and clear and detailed pictures are required. So that the initial process for preparing shop drawings, composite drawings, methods and adjustments to the conditions of the work area of the related work scope items can be minimized planning and implementation errors, new risks do not occur / spread to other previously unrelated risks, as well as adjusted schedules. can be achieved smoothly.
- e. Coordinate and review the condition of the existing drawings and the status of the shop drawing / composite drawing in relation to the type of work involved. This is related to work items that have links to other contractors so that the risk of overlapping / collision sequences can be avoided and overlapping works can be detailed in the duration of time.

5.1. Suggestions

Based on the results of this research study, it can be suggested:

- a. It is expected that all parties / stakeholders involved in project implementation, both owners / owners, consultants, contractors, suppliers and other parties can reduce the risk of delays in construction projects by communicating and coordinating well and intensively, adjusting the schedule to the priority scale. scope of work, and completeness of data files related to the addition of the scope of work.
- b. Monitoring and reviewing discussion of risks should be carried out periodically so that previously unknown risks can be identified early, so that the next mitigation action strategy steps are obtained to better handle preventive action against emerging risks.

Suggestions for further research are to increase the number of respondents and the number of projects in order to obtain better data accuracy. As well as research on the conflicts that occur will be able to help resolve conflicts so as not to have an impact on delays in project completion. And there is a need for a cost review so that the impact of the risk of cost loss due to delays experienced by stakeholders is necessary (from reviews of the owner or contractors / sub contractors).

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Biography / Biographies (Optional)

H. Fredy Kurniawan, ST., MT., M.Eng., Ph. D is Senior Lecturer of Civil Engineering, Department of Civil Engineering, Faculty of Engineering, Narotama University Surabaya, Jalan Arif Rahman Hakim 51, Surabaya; B. Eng Construction Management (2000-2005) at Universitas Kristen Petra, Surabaya; M.Eng Construction, Engineering and Infrastructure Management (2006-2007) at Asian Institute of Tecnology; Magister Teknik Construction Management (2006-2008) at Universitas Kristen Petra, Surabaya; PhD Construction Project Management (2008-2011) at Heriot-Watt University.

Nyoman Agus Sandika Purnaman is Student of Civil Engineering (Magister Teknik Sipil 2019-2020), Department of Civil Engineering, Faculty of Engineering, Narotama University Surabaya, Jalan Arif Rahman Hakim 51, Surabaya; B. Eng (1993-1998) Civil Engineering at Institut Teknologi Nasional, Malang.