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Analysis of Delay Factors for The Implementation of Road and Bridge Projects in The Department of Public Works and Spatial Planning in South Kalimantan Province

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ABSTRACT : *There are various obstacles to implementing road and bridge projects in South Kalimantan Province. Common obstacles in project implementation relate to lack of resources (material, labor, and funds), inadequate work equipment, design changes, and various other problems. These multiple obstacles then resulted in several projects experiencing delays. Delays in project completion can result in project cost overruns and result not being achieved. This study aims to determine the index value and obtain the dominant factor causing delays in road and bridge projects at the PUPR Office of South Kalimantan Province. The method used is distributing questionnaires related to the sub-factors that affect the delay in road and bridge projects in 2020. The respondents in this study were parties directly involved in the project in question, with 83 respondents. After the respondents filled out the questionnaire, the data was then tabulated and scored using index and variance analysis. The questionnaire consists of 41 sub-factors spread over each of the 7 factors. Based on the analysis results, 17 dominant sub-factors and 2 most dominant sub-factors are causing delays. The most dominant sub-factors are natural disasters and delays in material delivery to the project site. These dominant factors then prioritize which has the highest average index value based on the type of delay, and then mitigation is prepared to minimize project delays. The steps taken to minimize project delays include reviewing the time schedule and RAB and conducting coordination meetings.*
KEYWORDS: *delay factor, road project, bridge project, index, and variance analysis*

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I. INTRODUCTION

Road and bridge construction is positively correlated to the economic growth of a region, where better transportation facilities and infrastructure will accelerate the rate of economic development of a region, strengthen unity and integrity and affect almost all aspects of life. In the implementation of road and bridge projects, there are various obstacles/problems. Problems in project implementation are generally related to lack of resources (material, labor, and funds), inadequate work equipment, design changes, and various other problems.

These problems resulted in delays in the project completion schedule. Delay in project completion will impact project cost overruns, and results (output) will not be achieved. Because of the magnitude of the impact, there is a need for project risk management. Project risk management means systematically identifying the types, amounts, and sources of risk during the project cycle and preparing appropriate responses to deal with these risks (Rani, 2016).

In this study, researchers suggested that the Covid-19 pandemic might also be one of the factors causing delays in the completion of road and bridge projects at the PUPR Office of South Kalimantan Province in 2020. As a result of the Covid-19 pandemic, the government imposed a Large-Scale Social Restrictions (PSBB) policy. As a result, there are restrictions on transportation and mobilization in several areas with high/medium risk zones. So, from several factors causing delays in project completion, it is hoped that the most dominant sub-factors in influencing the construction project delays understudy can be identified. The purpose of this study was to determine the index value of each of the factors causing delays in road and bridge projects at the PUPR Service of South Kalimantan Province in 2020 and determine the dominant factors causing delays in road and bridge construction projects in South Kalimantan Province which were the most dominant in 2020.

II. LITERATURE REVIEW

According to Rani (2016), a project is carried out with limited time and resources to achieve the specified final result. In addition, a construction project is a series of interrelated activities to achieve specific goals (building/construction) within a particular time, cost, and quality constraints. Every project activity in achieving its goals and objectives has several factors that influence the success of a project, namely economic, technical and human factors. These three factors influence each other and are related (Soeharto, 1995).

In achieving the goals of a project, some limitations must be met, namely cost (budget), schedule (time), and quality (performance) that have been determined. These three limitations are essential parameters for project organizers who are often associated with project targets, where these three constraints are often referred to as three constraints (triple constraints).

According to Ervianto (2004) there is a relationship between the parties involved in a project, which is generally distinguished by functional relationships and formal working relationships. Functionally there are 3 parties who play a critical role in a construction project, namely the project owner, the consultant, and the contractor. Project delays can be seen in two ways: aspects that are affected and factors that influence or are the cause. Several factors that influence the delay of the project are delays in labor, materials, design, equipment, planning and implementation, financing, social environment, community, and managerial.

According to Lewis and Atherley (1996), project delays are often a source of disputes and demands between the owner and the contractor. So the value will be costly both in terms of the contractor and the owner. The delay in implementation of the project also has an impact in the form of losses for all parties involved in the project.

In projects that are already experiencing delays, risks that impact implementation has occurred. The risk that occurs is a problem (Hairiyah, 2018). This happens because of the inadequate risk management made. Therefore, it is necessary to propose strategic recommendations for accelerating construction projects based on experience. Before determining the risk response, it is necessary first to know the cause of the occurrence of the risk (Yuliana and Gawit, 2017). The causes of these risks were obtained from the results of interviews. The risk response is also categorized based on the cost and time aspects.

This study analyzes the factors that cause project delays from literature studies and previous research. However, the problems also occur in the project within the Provincial PUPR Office of South Kalimantan in 2020. The author wants to analyze whether the Corona Virus Disease 2019 (Covid-19) pandemic is one of the factors causing the project to experience delays in completing work. Due to the COVID-19 pandemic, the government imposed Large-Scale Social Restrictions (PSBB) to accelerate the handling of COVID-19. The implementation of PSBB is carried out during the most extended incubation period (14 days). If there is still evidence of spread in the form of new cases, it can be extended within 14 days since the discovery of the last case. The PSBB policy by the Regional Government in the form of closing access to and from entering certain areas and restrictions on public transportation has impacted the availability and limited mobility of labor and construction materials.

The stages in the statistical analysis method used in the study include validity testing, data analysis theory, sampling theory, measurement scale, theory of data types and sources, and non-parametric.

III. RESEARCH METHODS

This research was carried out in several stages. These stages consist of a preliminary study, data collection, questionnaire instrument testing, index and variance analysis, descriptive analysis, strategy development, and concluding.

3.1 Preliminary Study

This research begins by formulating the problem and research title supported by all literature reviews. Furthermore, in implementing this research, the researcher conducted a preliminary study of some literature and previous research related to project management and the factors that cause delays in project implementation, especially road and bridge projects.

3.2 Data Collection

In this study, the research object is a project or work at the Public Works and Spatial Planning Office of South Kalimantan Province, which experienced delays in implementing work in the 2020 fiscal year.

1. Primary data is data obtained directly through interviews with experts, observations, and the results of filling out questionnaires distributed to respondents.
2. Secondary data is data obtained indirectly. Secondary data is obtained through literature studies or previous research, road and bridge project data such as RAB, contract data, documentation, time schedule, physical reports, etc.

In addition, the data will also be determined using a Likert that shows the level of influence of each factor according to the respondent. The data were collected, tabulated, scored, and analyzed using index analysis and variance. The index value and variance of each subfactor can be known using the index. The greater the index value, the greater the influence of the subfactor on project delays. Index values are not only used for sub-factors but can also be used to determine factor index values.

3.3 Testing the Questionnaire Instrument

Before analyzing the data, it is necessary to test its validity and reliability of the data. Validity shows the extent to which the scores/values/measurements are obtained to state the results of the measurements/observations to be measured after the data is declared valid and reliable.

3.4 Index and Variance Analysis

Next, an analysis will be carried out to determine the dominant factor as the cause of project delays. After that, weighting was also carried out on each scale of affirmation of respondents' answers of -100, -50, 0, +50, and +100. In addition, the data will also be determined using a Likert that shows the level of influence of each factor according to the respondent. The data were collected, tabulated, scored, and analyzed using index analysis and variants. Because the maximum index value is 100 and the answer scoring category is 5 (five) categories, then to present the results of the dominant factors as the cause of delays in the implementation of work by using guidelines for interpreting the factors causing delays in the implementation of work.

3.5 Descriptive Analysis

Descriptive analysis is used to reveal and provide an overview of everything related to the respondent. In addition, the opinion of respondents related to the object of research is also used as a material for discussing the results of the study's quantitative analysis.

3.6 Conclusion Drawing

Conclusions are drawn up based on data analysis and discussions carried out previously. The conclusions obtained must follow the study's objectives and not out of the limitations of the problem.

IV. DISCUSSION OF RESEARCH RESULTS

4.1 Research Objects

There are 5 (five) pieces of work that experience delays in the implementation of work, including the following.

1. Construction of the Aranio Bridge
2. Construction of the Sei Jelai-Batu Ampar Bridge
3. Construction of the Highest Roads and Bridges-Kodeco 58
4. Construction of the Termunih River Bridge II
5. Construction of the Kusan River Bridge II

4.2 Research Respondents

The four elements of the respondents are detailed in the recapitulation of the number of research samples described in Table 1.

Table 1. Recapitulation of the Number of Research Samples

No	Element	Number
1	Service User (Department of PUPR Kalsel)	4
2	Service Provider (Contractor)	33
3	Consultant Supervisor	22
4	Consultant Planning	24
Total		**83**

4.3 Test The Validity and Reability of The Data

The following are the results of the validity and reliability testing calculation using the help of software statistics IBM SPSS Statistics 20.

Table.2 The results of the research sub-factor validity test

No.	Factors and Sub Factors Causing Work Lateness	Correlation Value
X_1	**Labor**	
X_{11}	Lack of availability of labor	0,659
X_{12}	Lack of expertise and skills and work motivation of workers who are directly in the field (site))	0,425
X_{13}	Inadequate number of workers /according to the activities in the field	0,765

No.	Factors and Sub Factors Causing Work Lateness	Correlation Value
X_{14}	Lack of discipline in the workforce	0,421
X_{15}	Low labor productivity	0,698
X_{16}	Work accidents in the workforce	0,592
X_2	**Equipment**	
X_{21}	Delay in the provision of heavy equipment	0,723
X_{22}	Damage to heavy equipment during project implementation	0,328
X_{23}	Lack of experience of mechanics/operators operating the use of high-tech tools in the field (site)	0,726
X_{24}	Low quality of equipment	0,690
X_{25}	Lack of equipment	0,755
X_3	**Materials**	
X_{31}	Scarcity of materials needed	0,660
X_{32}	Delays in material delivery to the project site	0,367
X_{33}	Material damage in storage	0,495
X_{34}	Change/change material	0,601
X_{35}	Poor material quality	0,617
X_4	**Information and Communication**	
X_{41}	Poor communication between contractors, sub-contractors, consultants, and owners	0,795
X_{42}	Poor communication within the contractor team	0.872
X_{43}	Changes in design before project implementation	0,266
X_{44}	The occurrence of design changes during project implementation	0,580
X_{45}	Design errors	0,703
X_{46}	Slow approval of working drawings	0,883
X_{47}	Delays in making decisions by owners	0,848
X_5	**Characteristics of Project Sites**	
X_{51}	Locations that are difficult to reach	0,801
X_{52}	The conditions and environment of the project site turns out to be inconsistent with expectations	0,858
X_{53}	Insufficient material storage place	0,233
X_{54}	Bad weather at the project site	0,627
X_{55}	Work area	0,725
X_6	**Project management**	
X_{61}	Lack of control of work in the field	0,453
X_{62}	Work permit approval process rambling	0,829
X_{63}	Late payment by the contractor	0,512
X_{64}	Cont inexperienced contractor	0,779
X_{65}	Poor supervision of work on the project	0,642
X_{66}	application of construction methods during implementation	0,858
X_{67}	Late payments by the owner	0,566
X_{68}	There is a lot of additional work	0,669
X_{69}	Work planning	0,829
X_7	**Incidents that Unexpected**	
X_{71}	Riot	0,596
X_{72}	Natural disaster	0,529
X_{73}	Worker's strike	0,607
X_{74}	Temporary suspension of work on projects located in the red zone	0,610

The following are the results of calculating the average score for each sub-factor and the value of the reliability test variance contained in Table 3.

Table 3. Variant Calculation Results for Reliability Test

No.	Factors and Sub-Factors Causing Work Lateness	$\bar{x}$	σ_i^2
X_1	**Workforce**		
X_{11}	Lack of workforce availability	4,49	0,351
X_{12}	Lack of expertise and skills and work motivation of workers who are directly in the field (site)	4,18	0,565
X_{13}	Total workforce inadequate work/according to activities in the field	4,40	0,608
X_{14}	Lack of workforce discipline	4,29	0,354
X_{15}	Low labor productivity	4,17	0,581
X_{16}	Work accidents in the workforce	3,76	0,746
X_2	**Equipment**		
X_{21}	Delay in providing heavy equipment	4,46	0,471
X_{22}	Damage to heavy equipment during project implementation	4,29	0,452
X_{23}	Lack of experience of mechanics/operators operating the use of high-tech equipment in the field	4,06	0,691
X_{24}	Low quality of equipment	3,81	0,377
X_{25}	Lack of equipment	4,13	0,482

No.	Factors and Sub-Factors Causing Work Lateness	$\bar{x}$	σ_i^2
X_3	**Material**		
X_{31}	Scarcity of required material	4,51	0,594
X_{32}	Delay in material delivery to the project site	4,63	0,237
X_{33}	Damage to forged materials t storage	3,69	0,462
X_{34}	Material change/change	3,67	0,881
X_{35}	Poor material quality	3,95	0,681
X_4	**Information and Communication**		
X_{41}	Poor communication between contractors, sub-contractors, consultants, and owners	4,30	0,725
X_{42}	Poor communication within the contractor team	4,17	0,557
X_{43}	Design changes occurred before project implementation	3,99	1,232
X_{44}	Design changes occurred during project implementation	4,53	0,325
X_{45}	Design errors	4,58	0,491
X_{46}	Slow approval of drawings work	4,18	0,565
X_{47}	Owner's delay in making decisions	4,33	0,637
X_5	**Characteristics of Project Location**		
X_{51}	The location that is difficult to reach	4,34	0,738
X_{52}	The conditions and environment of the project site are not as expected	4,20	0,433
X_{53}	Insufficient material storage area	3,84	1,061
X_{54}	Bad weather at the project site	4,40	0,316
X_{55}	Area	4,53	0,594
X_6	**Project management**		
X_{61}	Lack of work control in the field	4,24	0,697
X_{62}	Winded work permit approval process	4,00	0,561
X_{63}	Late payments by contractors	3,82	0,565
X_{64}	Contractors	4,18	0,857
X_{65}	Poor supervision of work on the project	4,25	0,825
X_{66}	Improper application of construction methods during implementation	4,59	0,611
X_6	**Project Management**		
X_{67}	Late payment by the owner	3,66	0,397
X_{68}	There is a lot of additional work	3,96	0,596
X_{69}	Work planning	4,22	0,489
X_7	**Events Unexpected**		
X_{71}	Riot	4,05	0,876
X_{72}	Natural disaster	4,72	0,252
X_{73}	Worker's strike	4,11	0,561
X_{74}	For projects located in the red zone	4,27	0,441
σ_t^2	**Number of Sub Factors Stoppage**	**386,155**	

4.4 Data Analysis Index and Variance

The ranking of sub-factors causing delays in overall work implementation based on the index and variance values is presented in Table 4.

Table 4. Index value and variance of sub-factors causing project delays

No.	Sub-Factor	Indeks	Variant	Ranking
Labor Factor (X_1)				
X_{11}	Lack of availability of manpower	74,70	4.989,17	8
X_{12}	Lack of expertise and skills as well as work motivation of workers who are directly in the field (site)	59,04	3.046,38	22
X_{13}	Inadequate number of workers/according to activities in the field	69,88	4.340,78	10
X_{14}	Lack of workforce discipline	64,46	3.664,77	15
X_{15}	Low labor productivity	58,43	2.981,19	25
X_{16}	Work accidents on workers	37,95	1.184,15	38
Equipment factor (X_2)				
X_{21}	Delay in the provision of heavy equipment	72,89	4.740,76	9
X_{22}	Damage to heavy equipment during project implementation	64,46	3.664,87	16
X_{23}	Lack of experience of mechanics/operators operating the use of high-tech tools in the field (site)	53,01	2.426,19	29
X_{24}	Low quality of equipment	40,96	1.352,88	37
X_{25}	Lack of equipment	56,63	2.789,70	27
Material factors (X_3)				
X_{31}	Scarcity of required material	75,30	5.073,67	7
X_{32}	Delay in material delivery to project site	81,33	5.954,68	2
X_{33}	Damage to material in the storage area	34,34	951,38	39
X_{34}	Substitution/change of material	33,73	915,52	40

No.	Sub-Factor	Indeks	Variant	Ranking
X_{35}	Poor material quality	47,59	1.928,23	34
Information and Communication Factors (X_4)				
X_{41}	Poor communication between contractors, sub-contractors, consultants, and owners	65,06	3.737,41	14
X_{42}	Poor communication within the contractor team	58,43	2.981,16	26
X_{43}	The occurrence of design changes before project implementation	49,40	2.088,41	32
X_{44}	The occurrence of design changes during project implementation	76,51	5.244,03	5
X_{45}	Design errors	78,92	5.593,92	4
X_{46}	Slow approval of working drawings	59,04	3.046,38	23
X_{47}	Owner's delay in making decisions	66,27	3.883,96	13
Factors Characteristics of Project Sites (X_5)				
X_{51}	Project locations that are difficult to reach	66,87	3.958,44	12
X_{52}	The conditions and environment of the project site are not according to the assumption	60,24	3.178,78	21
X_{53}	Storage area material insufficient	42,17	1.487,80	35
X_{54}	Bad weather at the project site	69,88	4.340,49	11
X_{55}	Work area	76,51	5.244,30	6
Project Management Factors (X_6)				
X_{61}	Lack of control work in the field	62,05	3.383,13	19
X_{62}	Winded work permit approval process	50,00	2.142,37	31
X_{63}	Late payments by contractors	40,96	1.397,11	36
X_{64}	Less experienced contractors	59,04	3.046,67	24
X_{65}	Poor supervision of work in the project	62,65	3.452,69	18
X_{66}	Application of construction methods during implementation	79,52	5.683,24	3
X_{67}	Late payments by the owner	33,13	879,46	41
X_{68}	There are a number of additional jobs	48,19	1.980,65	33
X_{69}	Work planning	60,84	3.246,15	20
Events Factors (X_7)				
X_{71}	Riots	52,41	2.368,23	30
X_{72}	Natural disasters	86,14	6.710,59	1
X_{73}	Workers' strike	55,42	2.665,72	28
X_{74}	Temporary suspension of work on projects located in the red zone	63,25	3.522,45	17

4.5 Analysis of The Causes of Delay

From the questionnaire data that was analyzed using index and variance analysis, a total of 19 dominant sub-factors caused project implementation delays. Of the 19 sub-factors, 2 are very dominant sub-factors, and 17 other sub-factors are dominant. One of them is the lack of workforce availability (X11) which is the most dominant sub-factor in this study due to the PSBB due to covid-19. Problems in the form of delays in the provision of heavy equipment (X21), delays in material delivery to the project site (X32), and temporary termination of project work located in the red zone (X74) are included in the dominant sub-factors causing delays in work implementation. This happened because of the limitation of transportation modes on the materials needed in project implementation.

4.6 Mitigation of Causes of Delays in Work Implementation

The matrix of the relationship between sub-factors causing delays in work implementation and types of delays has been summarized in Table 5.

Table 5. Matrix of Relationships between Sub-Factors Causing Project Delays and Types of Project Delays

No	Sub-Factors	Types of Delays		
		ED	NED	CD
X_{72}	Natural disasters	86,14		
X_{32}	Delay in material delivery to project site		81,33	
X_{66}	Improper application of construction methods during implementation		79,52	
X_{45}	Design error			78,92
X_{55}	Insufficient work area		76,51	

X_{44}	There was a change in the design during the implementation of the project.			76,51
X_{31}	Scarcity of required materials		75,30	
X_{11}	Lack of labor availability		74,70	
X_{21}	Delay in providing heavy equipment		72,89	
X_{13}	Inadequate number of workers/according to activities in the field		69,88	
No	**Sub-Factors**	**Types of Delays**		
		ED	**NED**	**CD**
X_{54}	Bad weather at the project site	69,88		
X_{51}	Hard-to-reach project locations		66,87	
X_{47}	Owner's delay in making decisions			66,27
X_{41}	Poor communication between contractors, sub-contractors, consultants, and owners		65,06	
X_{22}	Damage to heavy equipment during project implementation		64,46	
X_{14}	Lack of workforce discipline		64,46	
X_{74}	Temporary suspension of projects located in the red zone			63,25
X_{65}	Poor supervision of work on the project			62,65
X_{61}	Lack of control over overwork in the field			62,05
AVERAGE		**78,01**	**71,91**	**68,28**

The sub-factor with the highest average index value will be prioritized for handling in this study. The priority of handling in question is in the form of preparation of mitigation of the sub-factors causing delays in the implementation of work in each type of delay. So, the preparation of mitigating the causes of delays in work implementation will prioritize the causes of Excusable Delay (ED) delays. The type of delay is Excusable Delay (ED), where the cause of the delay is not the negligence of any party. The force majeure/natural disaster in question is flooding in this study.

Meanwhile, the sub-factors cause the delay in the form of bad weather at the project site, which means that there is high rainfall over a long period of time at the location. The projects that experienced delays in the category of Excusable Delay (ED) in this study were compensated in the form of an extension of the implementation period provided by the KPA. The implementation period can be extended at least equal to the time when the contract is terminated due to force majeure. In this case, the Excusable Delay (ED) delay is caused by flooding and bad weather at the project site.

V. CONCLUSION

From the research that has been done, the following conclusions can be drawn:

1. The index and variance values for each of the sub-factors causing delays in the implementation of road and bridge projects within the Department of Public Works and Spatial Planning of South Kalimantan Province in the Highways Sector in 2020 were obtained
2. Of the 41 (forty-one) sub-factors causing delays in the implementation of road and bridge projects within the Department of Public Works and Spatial Planning of the Province of South Kalimantan in the Highways Sector in 2020, 17 dominant sub-factors and 2 most dominant sub-factors were obtained.
3. Mitigation that can be done to minimize delays in road and bridge construction projects within the South Kalimantan Provincial Public Works and Spatial Planning Department, the Highways Sector, is prioritized, which has the highest index value based on the type of delay category. In this study, the priority is the type of Excusable Delay (ED) delay, namely the sub-factor of natural disasters and bad weather at the project site.

Suggestion

Researchers can give that for future research are:

1. Further research is needed regarding the effect of the COVID-19 pandemic on the sub-factors causing delays in road and bridge projects in the 2021 years.

2. Because in this study, the approach to minimizing the delay factor is only based on the type of excusable delay. Further research can develop an approach to minimize the delay factor based on other delay types, namely non-excusable delay, and compensable delay.

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