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Modeling of Construction Project Delays Based on 3T Contextual Factors Using SEM-PLS

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ABSTRACT

Purpose: This study aims to analyze the factors that affect the delay of construction projects in the 3T region (frontier, outermost, and disadvantaged) and test the role of contextual variables in the relationship between these factors using the Structural Equation Modeling approach based on Partial Least Squares (SEM-PLS). The problem of project delays in the 3T region is crucial due to the characteristics of the region that has limited infrastructure, logistical access, and complex geographical conditions.

Design/methodology/approach: This study uses an explanatory quantitative design with primary data collected through a questionnaire to 187 respondents consisting of contractors, consultants, and project owners. The research instrument uses a Likert scale of 1–6 without a neutral option and has been tested for validity and reliability.

Findings: The results showed that project management, resources, and communication had a significant negative effect on project delays, while external factors had a significant positive effect. The contextual variables of the 3T region were shown to moderate the relationship between project management and delays. The research model was able to explain 67% of the variation in project delays.

Practical implications: This study concludes that construction project delays in the 3T region are the result of complex interactions between internal, external, and contextual factors of the region. The main contribution of this study is the integration of contextual variables in the SEM-PLS-based delay model which provides a more comprehensive approach in construction management studies.

Paper type: Research Paper.

Keyword: *Project Delays, 3T Regions, Project Management, SEM-PLS, Contextual Factors*
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I. INTRODUCTION

Construction project delays are a global phenomenon that has a significant impact on overall project cost, quality, and performance. In general, delays not only reflect implementation time deviations, but also indicate failures in risk management and coordination between stakeholders. In Indonesia, this problem is still a dominant issue, especially in infrastructure projects that have high complexity.

In the national context, various studies show that project delays are caused by a combination of technical and managerial factors, such as design changes, material delays, and weak project management. However, this complexity increases when projects are implemented in 3T areas that have limited infrastructure, low accessibility, and extreme geographical conditions.

The 3T region in Indonesia, particularly in Southwest Papua, faces unique challenges such as high logistics costs, limited skilled labor, and material distribution barriers. This condition causes project delays that cannot be explained through internal project factors alone, but require a more comprehensive contextual approach.

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Previous research is still generally partial and has not integrated contextual variables as a moderation factor in the project delay model. In addition, most studies use a descriptive or simple regression approach, so they have not been able to explain the structural relationships between variables simultaneously.

Based on these conditions, there is a research gap in understanding construction project delays holistically in the 3T area. Therefore, this study aims to develop a structural model of project delays by integrating internal, external, and contextual variables using the SEM-PLS approach.

A. Literature Review and Hypothesis Development

Construction project delays are a multidimensional phenomenon that is influenced by the interaction of various factors. Theoretically, the factors that cause delays can be classified into internal and external factors.

Internal factors include project management, resources, and communication. Project management plays a role in planning, control, and coordination, which determines the effectiveness of project implementation. Resources include labor, materials, and equipment that must be available in a timely manner. Communication plays a role in ensuring that coordination between parties runs effectively.

External factors include weather conditions, regulations, and project environments that are beyond the direct control of project management. Within the 3T area, external factors have a greater influence due to limited access and infrastructure.

The contingency approach in project management emphasizes that the effectiveness of a practice is strongly influenced by the environmental context. Therefore, contextual variables such as geographical conditions, accessibility, and logistics of the 3T region are positioned as moderation variables in this study.

Based on this theoretical framework, the hypotheses proposed are:

H1: Project management has a significant negative effect on project delays
H2: Resources have a significant negative impact on project delays
H3: Communication has a significant negative effect on project delays
H4: External factors have a significant positive effect on project delays
H5: Contextual variables of 3T regions moderate the relationship between project management and delays

II. METHODS

This study uses a quantitative approach with an explanatory design to test the causal relationship between variables. The research location is focused on the 3T region in Indonesia, especially Southwest Papua.

The data used was primary data obtained through a questionnaire to 187 respondents consisting of contractors, consultants, and project owners. The sampling technique used was purposive sampling with the criteria of a minimum of three years of experience in construction projects.

The research instrument used a Likert scale of 1–6 without neutral choice to increase the firmness of the response. The variables measured included project management, resources, communication, external factors, and regional contextual variables.

Data analysis was carried out using SEM-PLS with the evaluation stages of outer model and inner model. Convergent validity was assessed through loading factor (>0.7) and AVE (>0.5) values, while reliability was tested through Composite Reliability (>0.7). Hypothesis testing was carried out by bootstrapping with t-statistical criteria >1.96 and p-value <0.05.

III. RESULTS AND DISCUSSION

The results of the analysis showed that the entire construct met the criteria for validity and reliability. The AVE value was above 0.5 and the Composite Reliability was above 0.7, which indicates that the measurement model is feasible to use.

An R-square value of 0.67 indicates that the model is able to explain 67% of the variation in project delays. The results of the hypothesis test show that all variables have a significant influence.

Project management has a significant negative effect on delays, suggesting that improving the quality of planning and control can reduce the risk of delays. These findings are in line with previous research that emphasized the importance of managerial capacity in project success.

Resources also have a significant negative effect, which confirms that the availability of labor, materials, and equipment is a critical factor. In the context of the 3T region, logistical constraints reinforce the influence of these variables.

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Communication has a significant negative influence, which shows that effective coordination is able to reduce errors and delays. However, communication barriers in remote areas are a major challenge.

On the other hand, external factors have a significant positive effect on delays. This shows that weather, regulatory and environmental conditions have a major impact on projects in the 3T area.

The main finding of this study is the role of contextual variables as moderators. The results show that regional conditions reinforce the influence of project management on delays. This confirms that the project management approach must be adapted to local conditions.

IV. CONCLUSION

This study concludes that construction project delays in the 3T region are significantly influenced by internal and external factors, as well as moderated by regional contextual conditions. Project management, resources, and communication play a role in suppressing delays, while external factors increase the risk of delays.

The theoretical contribution of this research lies in the integration of contextual variables in the SEM-PLS-based project delay model. Practically, this research provides implications for improving risk-based project management and regional contexts.

It is recommended that further research develop models by incorporating digital technology variables and using longitudinal data to improve the accuracy of the analysis.

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Dear,
Suriano Buyung[1], Agustinus Purna Irawan[2], Mega Waty[3]
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We would like to inform you that based on the results of peer-review on the following article:
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Congratulations! Editor has been accepted for publication in IJEBD (International Journal of Entrepreneurship and Business Development) Volume 9 No 3, May 2026

We hereby declare that the said article is accepted and will be processed by the board of reviewers for further feedbacks.

This statements letter has been issued for use as stated and intended. Thank you for your cooperation.

Best Regards,
Chief Editor

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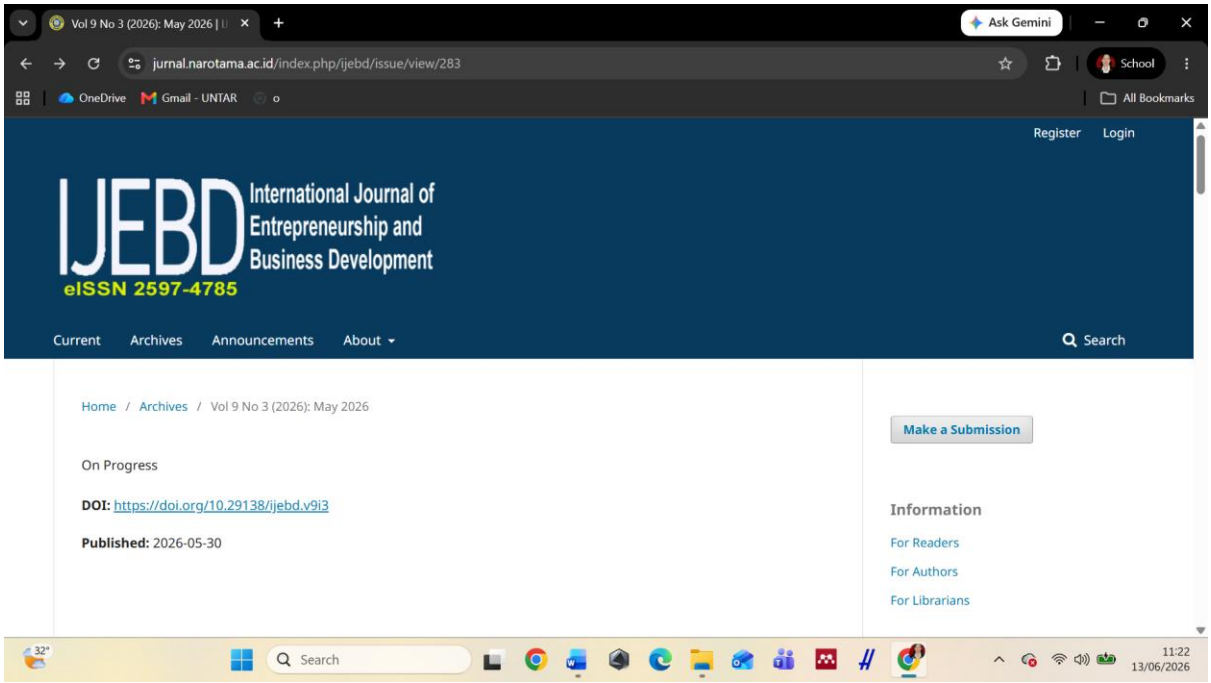
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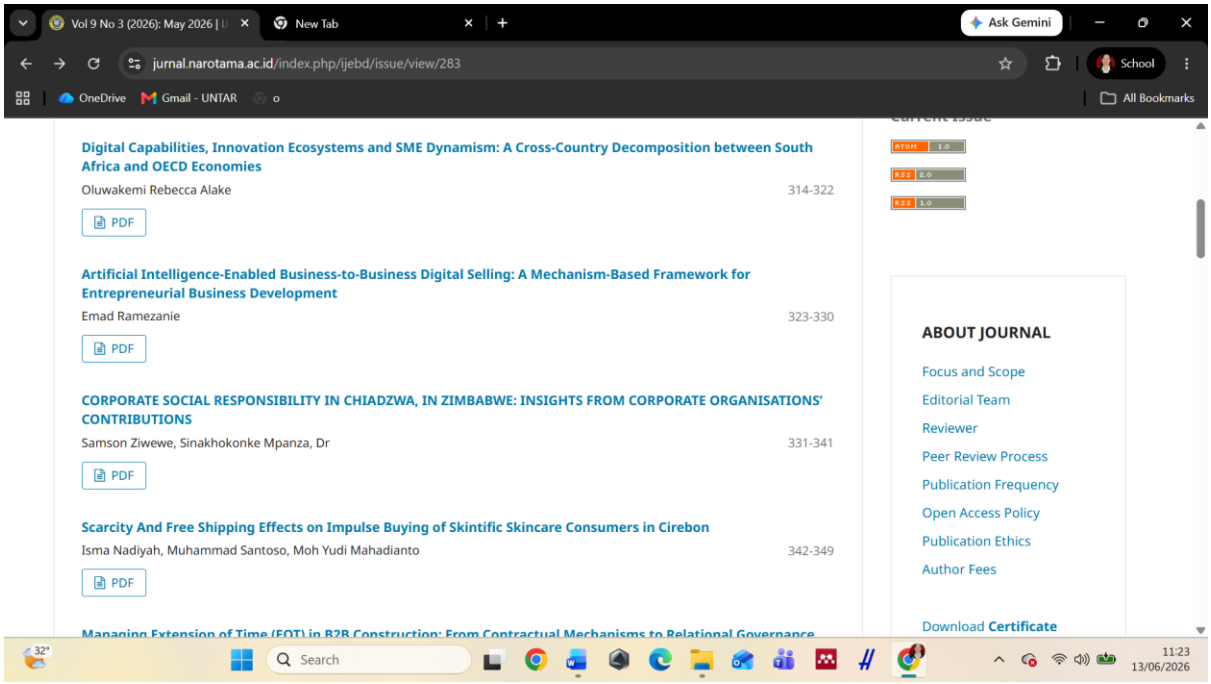
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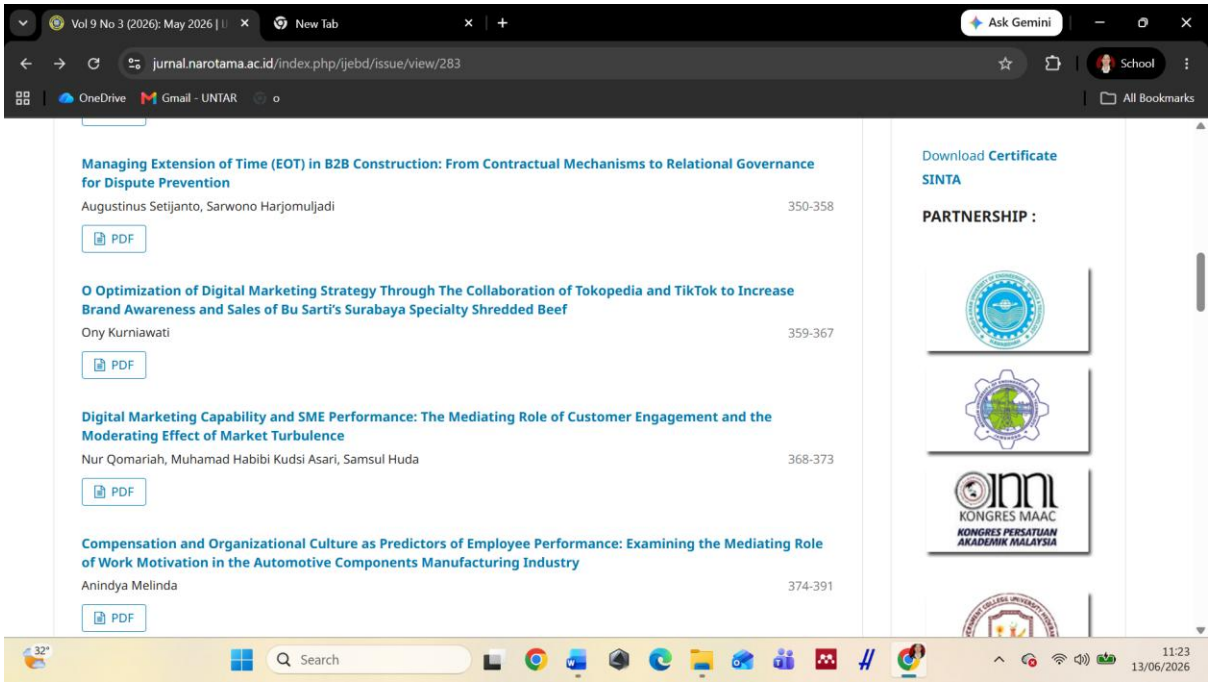
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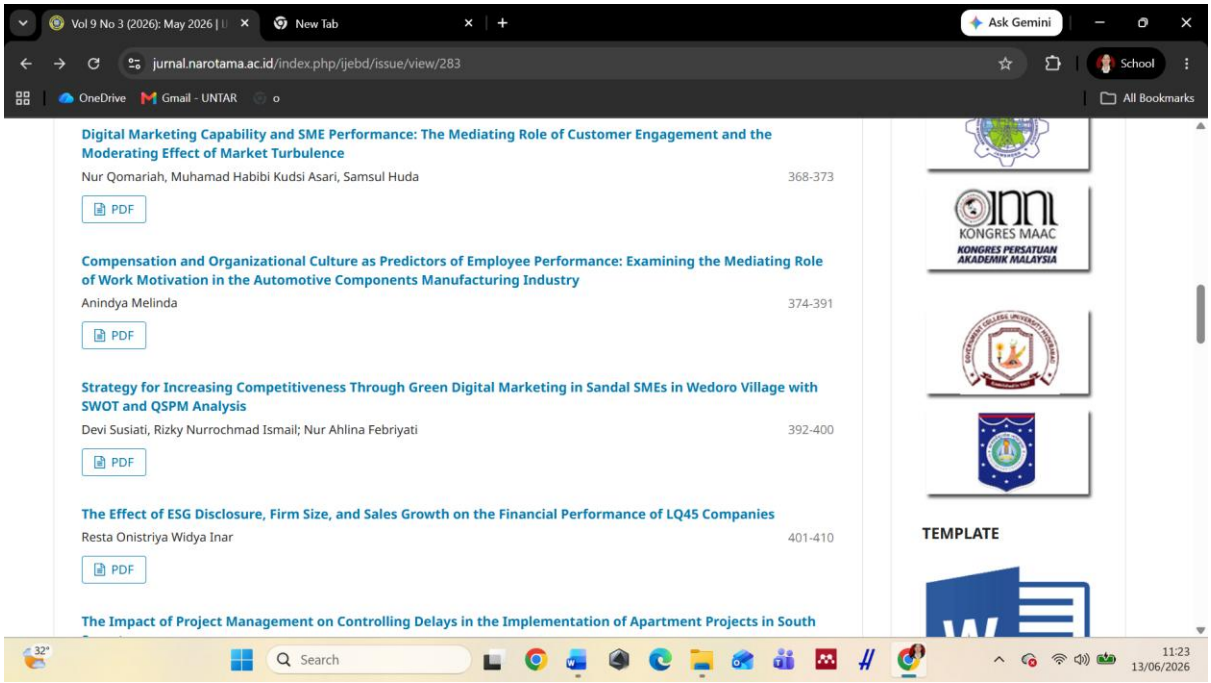
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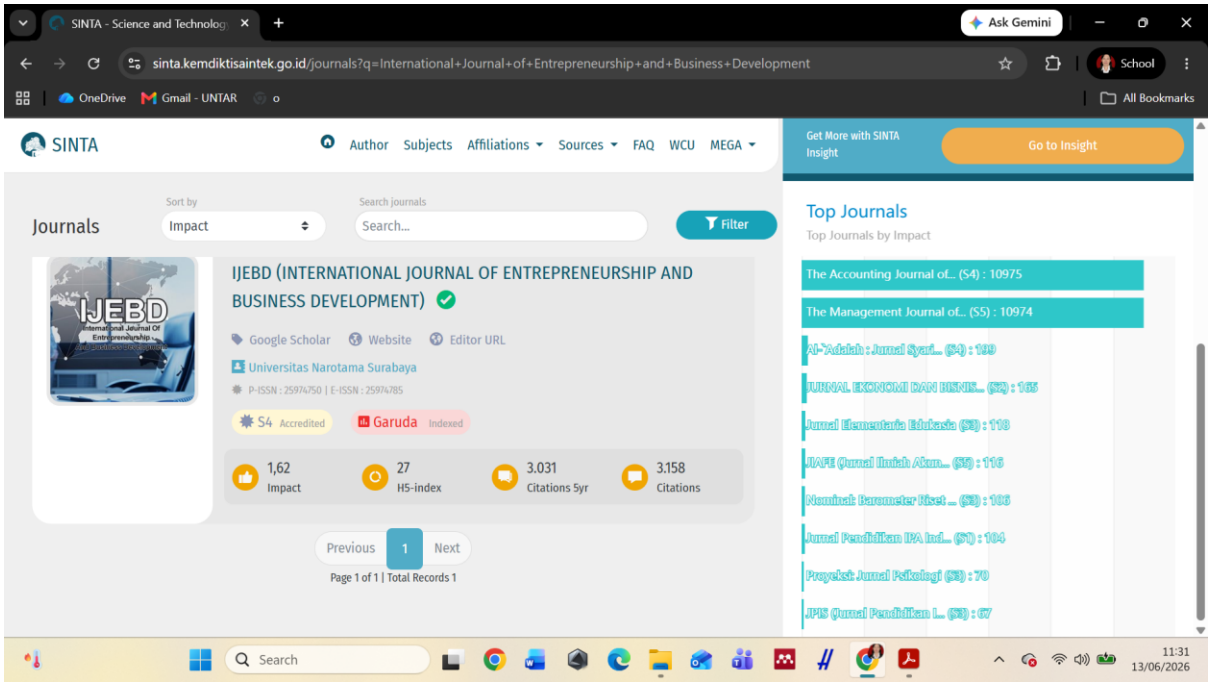
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