JURNAL TEKNIK SIPIL DAN LINGKUNGAN| EISSN:2549-1407
https://jurnal.ipb.ac.id/index.php/jsil

Vol. 10 No. 01 April 2025
DOI: 10.29244/jsil.10.1.127-138

Optimizing Organizational Performance in Bridge Maintenance using Stakeholder Analysis

Rully Andhika Karim[1], Naufal Budi Laksono[1,] *, Fahreza Ardiyanto[1], Yusuf Latief[1], and Bambang Trigunarsyah[2]

[1] Department of Civil Engineering, Faculty of Engineering, University of Indonesia, Depok, 16424 Indonesia
[2] School of Property, Construction and Project Management, RMIT University, Australia
*Corresponding author: naufal.budi04@ui.ac.id

Abstract: Bridge maintenance and care is an important aspect in maintaining the safety and efficiency of transportation infrastructure. However, challenges in coordination between various stakeholders often hamper operational effectiveness. This study aims to analyze the organization of bridge maintenance and care work using a stakeholder analysis approach, in order to improve organizational performance. The methods used in this study are qualitative and quantitative approaches, involving data collection through in-depth interviews and surveys of stakeholders, including the government, contractors, and user communities. The data obtained were analyzed to identify factors that influence organizational performance in bridge maintenance. The results show that active stakeholder involvement and effective communication contribute significantly to increasing efficiency and effectiveness in the bridge maintenance process. This study confirms that the application of stakeholder analysis can improve organizational performance in bridge maintenance by strengthening relationships between stakeholders and responding to their needs and expectations. Practical recommendations for the implementation of this strategy are presented, including the importance of communication training and collaboration between stakeholders. This study is expected to contribute to the development of policies and best practices in bridge infrastructure maintenance in the future.

Submitted: 14 Jan 2025
Revised: 6 Mar 2025
Accepted: 17 Apr 2025

Keywords: Bridge Maintenance; Organizational Performance; Project Management; Stakeholder Analysis; Stakeholder Engagement

1. Introduction

The development of road and bridge infrastructure in Indonesia is a crucial aspect in supporting economic growth and connectivity between regions. Good infrastructure not only functions as a connection between regions [1], but also as a major driver in creating jobs and expanding logistics networks [2]. Although the government has committed to improving infrastructure, the level of bridge instability in Indonesia still reaches around 80% in 2023 [3], much higher than developed countries such as the United States and the United Kingdom which each have an instability level of below 10% [4]. This indicates significant challenges in bridge maintenance and care that need to be addressed. Previous studies have shown that suboptimal bridge maintenance is one of the main causes of bridge damage and collapse in Indonesia [5-6].

Several studies have highlighted the importance of stakeholder management in the bridge maintenance and care process [7], but there has been no research that specifically analyzes the organization of bridge maintenance and care work using a stakeholder analysis approach. In addition, existing research has not conducted comparisons between organizations involved in bridge maintenance, resulting in a lack of understanding of the roles and responsibilities of each stakeholder in the context of infrastructure maintenance.

Existing solutions generally focus on increasing budget and resources for infrastructure maintenance [8-10], but this approach often does not consider effective stakeholder involvement and communication [11]. Therefore, there is an urgent need to conduct an in-depth analysis of stakeholder management in bridge maintenance and care work, in order to improve the performance of the responsible organizations.

This study aims to fill the existing gap by analyzing the organization of bridge maintenance and care work using a stakeholder analysis approach. Specifically, this study will identify stakeholders involved, analyze the level of interest and power of each stakeholder, and develop an effective engagement strategy [12]. Thus, it is hoped that this study can provide a significant contribution in improving the performance of organizations related to bridge maintenance in Indonesia and ensuring the safety and comfort of road users.

2. Stakeholder Management Methods & Strategies: A PMBOK 6th Edition-Based Approach

In the context of infrastructure project management, stakeholder management is a very important aspect to ensure the success and smoothness of each stage of the project [13]. A deep understanding of stakeholders, as well as the right strategy in involving them, can contribute significantly to organizational performance and the final results of the project.

2.1. Stakeholder Management

Stakeholders can be individuals, groups, or organizations that may influence, be affected by, or feel affected by a decision, activity, or outcome of a portfolio, program, or project [14]. Stakeholders also directly or indirectly affect a project, its performance, or its outcomes either positively or negatively [15]. Stakeholder management is a series of important processes to identify individuals, groups, or organizational entities that have the ability to influence or are affected by the course of a project [16].

Stakeholder analysis generally refers to a variety of techniques or tools for identifying and understanding the needs and expectations of key stakeholders inside and outside the project environment. Understanding the attributes, interactions, and interfaces between project supporters and opponents helps in strategically planning the project [17]. Based on PMBOK 2017, the project stakeholder management process consists of several stages, namely:

1. Stakeholder Identification: This process involves routinely identifying project stakeholders and analyzing and documenting relevant information regarding their interests, involvement, relevance, influence, and potential impact on the success of the project.
2. Stakeholder Engagement Planning: The process of developing an approach to engage project stakeholders based on their needs, expectations, interests, and potential impacts on the project.
3. Stakeholder Engagement Management: The process of communicating and working with stakeholders to meet their needs and expectations, address issues, and encourage appropriate stakeholder involvement.
4. Stakeholder Engagement Monitor: The process of monitoring project stakeholder relationships and adjusting strategies to engage stakeholders through modifications to engagement strategies and plans.

The stakeholder identification process is a crucial initial stage in stakeholder management, especially in the context of road and bridge maintenance and care work [18]. This identification aims to identify all individuals, groups, or organizations that have an interest in, and can influence or be

influenced by, the project. By understanding the roles, expectations, and needs of stakeholders, the project team can manage their relationships more effectively .

2.2. Stakeholder Identification

Stakeholder identification is a crucial initial step in the management of bridge maintenance and care projects [19]. It involves identifying and gathering information about individuals, groups, or organizations that can affect or be affected by the project. This process includes several inputs, tools & techniques, and outputs derived from the PMBOK:

Stakeholder Identification Input:

1. Project Documents: Project documents such as Contract Agreements, Project Plans, and technical specifications provide an initial understanding of the project.
2. Project Scope Statement: A detailed description of what the project will achieve helps in identifying relevant stakeholders.
3. Risk Register: Information about project risks helps in identifying stakeholders associated with a particular risk.

Tools & Techniques for Stakeholder Identification:

1. Stakeholder Mapping: Creating a map or diagram that depicts the relationships between various stakeholders.
2. Interviews: Conduct interviews with various parties involved to identify stakeholders who have not been identified.
3. Surveys and Questionnaires: Using surveys or questionnaires to collect data from stakeholders who may not be able to be met in person.

Stakeholder Identification Output:

1. Stakeholder List: A complete list of individuals, groups, or organizations that have an interest in the project.
2. Stakeholder Description: A brief description of each stakeholder, including relevant information about their characteristics, primary interests, and influence on the project.
3. Stakeholder Classification: Grouping or classification of stakeholders based on their characteristics or types of interests.

The stakeholder identification process provides an important foundation for designing communication, engagement, and management strategies that are appropriate to the interests and influence of each stakeholder. With the right information about the stakeholders involved, the project team can minimize risks, increase stakeholder support, and better achieve project objectives.

2.3. Power and Interest of Stakeholders

The power and interest matrix is a strategic tool for stakeholder management [20]. This matrix is used by project managers to identify, classify, and manage stakeholders and their interactions. Stakeholders are categorized based on their level of power and interest in the project, which helps in managing communication channels and ensuring stakeholder satisfaction from the planning stage to project completion.

1. Stakeholders with High Power, High Interest (Manage Closely): The most important stakeholders in the project who must be prioritized to maintain satisfaction and communication.
2. Stakeholders with High Power, Low Interest (Keep Satisfied): These stakeholders must be satisfied, but do not need to communicate frequently.
3. Stakeholders with Low Power, High Interest (Keep Informed): Must keep them informed regularly to ensure they do not experience any problems.

4. Stakeholders with Low Power, Low Interest (Monitor/Minimum Effort): Just keep informing them periodically but not excessively.

The stakeholder matrix is a valuable tool in project management to identify, analyze, and manage stakeholders. By using the matrix, project managers can describe and understand the relationships between stakeholders and the ongoing project, and plan efficient strategies to interact and meet their needs.

2.4. Research Procedures

This research was conducted with a qualitative and quantitative approach to analyze stakeholder management in bridge maintenance and care projects. The research process consists of several systematic steps, starting from stakeholder identification to developing an engagement strategy. The following are the steps taken in this study:

Table 1. Research Process

Step	Description
1. Identify Stakeholders	Identify all stakeholders involved in the bridge maintenance and care project. This includes internal and external stakeholders, as well as classification based on their hierarchy and roles.
2. Power and Interest Analysis	Analyze the level of power and interest of each stakeholder using the power and interest matrix to determine priorities in engagement management.
3. Stakeholder Engagement & Engagement Strategy Development	Measuring the level of involvement of each stakeholder in the project, including how they are affected and influence the project. This is done through surveys and interviews.
	Design an effective engagement strategy for each stakeholder based on the results of the previous analysis, including appropriate communication and interaction methods.
4. Implementation and Monitoring	Implement the designed engagement strategy and monitor its effectiveness throughout the project, making adjustments if necessary.

The research (based on **Table 1**) was conducted with a qualitative and quantitative approach to analyze stakeholder management in bridge maintenance and care projects. The research process consists of several systematic steps, starting from stakeholder identification to developing an engagement strategy. The first step in this study is stakeholder identification, which includes all stakeholders involved in the bridge maintenance and care project, both internally and externally. In addition, stakeholders are classified based on their hierarchy and role in the project. Furthermore, a power and interest analysis is carried out using a power and interest matrix to determine the level of power and interest of each stakeholder in the project. This analysis aims to determine priorities in engagement management.

After that, this study focuses on stakeholder engagement and engagement strategy development. At this stage, the level of stakeholder engagement in the project was measured by considering how they are affected by the project and how they can influence the success of the project. Data collection was done through surveys and interviews. Based on the results of the analysis, an effective engagement strategy was then designed, including communication and interaction methods that are appropriate for each stakeholder. The last stage was implementation and monitoring, where the designed engagement

strategy was applied in the project. During this process, the effectiveness of the implemented strategy was monitored periodically, and adjustments were made if necessary to ensure that stakeholder engagement remained optimal throughout the project.

3. Results and Discussion: Stakeholder Management of Bridge Maintenance Organization

This study relies on the use of primary and secondary data. Primary data was obtained through interviews with experts and specialists who have in-depth knowledge of bridge maintenance and care, in order to obtain responses to the variables in the questionnaire that will be given [21]. Meanwhile, secondary data was accessed from other sources such as books, journals, theses, and dissertations. The data collection process was carried out in four stages, where each stage involved a minimum of five experts with a minimum of 10 years of experience and an education equivalent to a Masters, to ensure the validity and credibility of the data obtained.

Table 2. Research Expert Data

No.	Expert	Position	Education	Work Experience (Years)
1	Pack 1	Technical Director	Doctoral	20
2	Pack 2	Academics	Doctoral	15
3	Pack 3	VP Strategic Planning	Masters	18

This study relies on primary and secondary data. Primary data were obtained through interviews with experts who have at least 10 years of experience and education equivalent to a Master's degree, including technical directors (Doctoral, 20 years of experience), academics (Doctoral, 15 years), and VP Strategic Planning (Masters, 18 years) as shown in **Table 2**. Secondary data gathered from books, journals, undergraduate and graduate theses. Data collection was carried out in four stages to validate the organizational structure, stakeholder power & interest, and involvement strategies in bridge maintenance. Validation tests were carried out to ensure the validity of the data with strong references from experts. Each stage of data collection aims to validate information related to the organizational structure, stakeholder power & interest, stakeholder involvement, and involvement strategies required in bridge maintenance and care. Validation tests were carried out to ensure that the data obtained has a high level of validity and is supported by strong references from related experts.

3.1. Identification of Bridge Maintenance Stakeholders

Stakeholders were categorized based on their type and hierarchy, which includes asset owners, consultants, contractors, and regulators. This classification is important to understand who has influence and interest in the project, and to design the right engagement strategy as refer to **Table 3**.

With a deeper understanding of who is involved and their roles, the project team can design a more focused and effective engagement strategy. This is expected to contribute significantly to the success of the bridge maintenance and care project.

Table 3. Identification of Bridge Maintenance Stakeholders

Types of Stakeholders	Stakeholder Hierarchy	Code	Stakeholder Scope	Information
Internal	Veto	X1	Asset Owner	Government (BBPJN/BPJN, Provincial PUPR Service), BUMN (PT. Jasa Marga, Private (PT. Astra Infra)
	Key	X2	Consultant (Technical)	KKJTJ, Bridge Center, Academic Expert
	Primary	X3	Main Contractor	State-owned Enterprises, Private
		X4	Planning Consultant	State-owned Enterprises, Private
		X5	CM Consultant	State-owned Enterprises, Private
		X6	Sub Contractor	State-owned Enterprises, Private
		X7	Supplier	(Goods and services)
External	Secondary	X8	Regulator	DJBM, BPJT
		X9	Media Press	Mass media
		X10	Local communities	Public figure
		X11	Bridge Users	Vehicle Driver
		X12	Legal Apparatus	TNI, POLRI, Prosecutor's Office

3.2. Power & Interest Stakeholders of Bridge Maintenance

The Power-Interest Grid Matrix is an effective analytical tool for mapping stakeholders in bridge maintenance and care projects, based on two main dimensions: power and interest. In the context of this study, stakeholders involved have been identified and categorized according to a variable table that includes asset owners, consultants, contractors, and regulators. This mapping process aims to understand the position and role of each stakeholder in the project, and to formulate appropriate engagement strategies.

Power-Interest matrix analysis are shown in Figure 1 where stakeholders placed in the first quadrant, "Meet Their Needs," consist of X10 (Local Community) and X12 (Legal Apparatus). Both groups show high power and interest in the project, so fulfilling their needs is crucial. Active involvement of these stakeholders can increase support and reduce the risk of conflict due to dissatisfaction. Therefore, a responsive engagement strategy is needed to accommodate their aspirations. The second quadrant, "Manage Closely," includes stakeholders with high power and moderate interest, such as X1 (Asset Owner), X2 (Consultant (Technical)), X3 (Main Contractor), X4 (Planning Consultant), X5 (CM Consultant), X6 (Sub Contractor), and X8 (Regulator). These stakeholders require careful management, with an effective communication strategy to ensure their involvement in decision making.

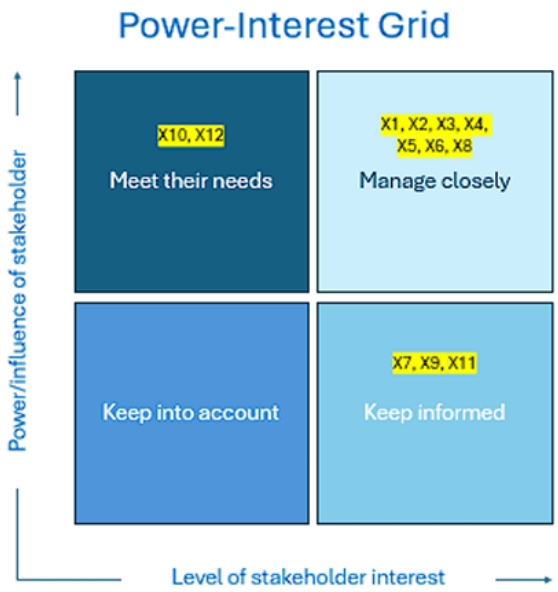

Figure 1. Power – Interest Matrix of Bridge Maintenance Organization

In the third quadrant, "Keep Into Account," are stakeholders such as X7 (Supplier), X9 (Media Press), and X11 (Bridge Users). Although they have low power, their interest remains high, making it important to heed their input to maintain support for the project. The fourth quadrant, "Keep Informed," includes stakeholders with low power and interest. Although there are no clear stakeholders in this category, it is important to provide them with relevant information to maintain transparency and trust. Overall, mapping using the Power-Interest Grid matrix provides insight into the dynamics of stakeholder relationships, allowing the project team to formulate more effective engagement strategies to improve the success of the bridge maintenance and care project.

3.3. Stakeholder Engagement & Bridge Maintenance Organization Optimization Strategy

Stakeholder involvement in bridge maintenance and care projects is a crucial aspect that influences the success of the project. Based on the results of expert validation, various roles, expectations, and responsibilities of each stakeholder have been identified. This process resulted in seven stakeholders requiring collaborative engagement strategies and five stakeholders requiring information provision strategies.

The collaborative engagement strategy involves dialogue and consultation, which aims to build strong and mutually beneficial relationships between the parties involved. Meanwhile, the information provision strategy is carried out through the submission of written reports and information regarding the progress of bridge maintenance and care. This approach is expected to increase transparency and trust among all stakeholders.

The results of the analysis showed that all experts agree on the roles, expectations, and responsibilities of each stakeholder. Thus, no changes were needed in the engagement strategy that had been formulated. A collaborative approach and the provision of appropriate information are expected to increase the effectiveness of stakeholder engagement, as well as support the success of the overall bridge maintenance and care project.

Table 4. Bridge Maintenance Stakeholder Engagement Strategy

Code	Stakeholder	Role	Expectation	Responsibility	Engagement Strategy
X1	Asset Owner	Initiating strategic direction	Bridge quality is maintained	Provide budget, monitor conditions	Manage Closely, Dialogue
X2	Consultant (Technical)	Providing technical recommendations	Accurate recommendations and effective solutions	Performing technical analysis	Manage Closely, Consultation
X3	Main Contractor	Carrying out work	Costs do not exceed budget	Coordinating work	Manage Closely, Dialogue
X4	Planning Consultant	Develop a maintenance plan	Comprehensive and measurable plan	Making a work plan	Manage Closely, Consultation
X5	CM Consultant	Supervise the implementation	Project as per specification	Supervision of implementation	Manage Closely, Dialogue
X6	Sub Contractor	Executor of certain jobs	Costs according to budget	Main contractor assistant	Manage Closely, Dialogue
X7	Supplier	Material vendors	Availability of required materials	Preparation of tools and materials	Keep Informed
X8	Regulator	Regulatory regulator	Technical requirements according to standards	Establish a relationship	Manage Closely, Dialogue
X9	Media Press	News distributor	Maintenance went smoothly	Provision of information	Keep Informed
X10	Local communities	Environmental impact	No negative impact	Provision of information	Keep Satisfied
X11	Bridge Users	Accessibility	Maintenance went smoothly	Provision of information	Keep Informed
X12	Indonesian National Armed Forces/ Indonesian National Police	Security guarantor	Maintenance went smoothly	Maintaining security, responding to incidents	Keep Satisfied

3.4. Implementation and Monitoring of Stakeholder Involvement in Bridge Maintenance

Implementation of the designed stakeholder engagement strategy is critical in the context of bridge maintenance. This process involves implementing the established strategy to ensure that all stakeholders, including asset owners, contractors, consultants, and the community, are actively involved in every stage of maintenance as shown as in **Table 5**. Monitoring is conducted to evaluate the effectiveness of the strategy throughout the project, as well as to identify areas that require adjustment.

Table 5. Bridge Maintenance Stakeholder Involvement Implementation and Monitoring Plan

Step	Description	Success Indicators	Monitoring Frequency	Adjustment Action
Strategy Implementation	Implement engagement strategies according to the plans, including dialogue with the community and collaboration with contractors.	Stakeholder engagement increased, positive feedback from the community.	Monthly	Evaluate and revise strategy if necessary based on feedback.
Data collection	Collecting data on feedback and responses from stakeholders, including local communities and bridge users.	Feedback data collected and analyzed, stakeholder satisfaction reports.	Every 3 months	Data analysis to adjust engagement strategies.
Evaluation of Effectiveness	Assess the effectiveness of engagement strategies based on data collected, including the impact of maintenance on traffic and safety.	Stakeholder satisfaction levels increased, there are no maintenance-related incidents.	Every 6 months	Strategy adjustments based on evaluation results and feedback.
Reporting	Prepare reports on the results of monitoring and evaluation, as well as the impact of maintenance on the condition of the bridge and the community.	Reports are prepared and shared with stakeholders, information transparency.	Every 6 months	Discuss report results with stakeholders to obtain input.
Strategy Adjustment	Make adjustments to the strategy based on monitoring and evaluation results, including adjusting maintenance schedules if necessary.	More effective strategies implemented, improved communication with stakeholders.	According to the needs	Implementation of new strategies based on evaluation results.

Effective implementation and monitoring of stakeholder engagement strategies in bridge maintenance are critical to achieving project objectives. By actively involving all stakeholders and conducting periodic evaluations, the project team can ensure that bridge maintenance is carried out

properly, safely, and in accordance with community expectations. Necessary adjustments will help improve the effectiveness of stakeholder engagement, thereby supporting the overall success of bridge maintenance and care.

3.5. Findings & Discussion

This study successfully identified and analyzed the roles and expectations of various stakeholders involved in bridge maintenance and care projects. Through a PMBOK 6th edition-based approach, seven key stakeholders were found that required collaborative engagement strategies, namely:

1. Asset Owner : Has a key role in initiating strategic direction, providing funding, and inspecting the condition of the bridge. Their expectations are to maintain the quality of the bridge and safety.
2. Technical Consultant : Responsible for providing technical recommendations and appropriate solutions. They are expected to provide accurate analysis for maintenance and repairs.
3. Main Contractor : Performs the work in accordance with the owner's directions and design specifications. They are expected to keep the costs and work methods in line with the plans.
4. Planning Consultant : Develops a comprehensive and measurable maintenance plan. Their expectation is to produce a plan that can be implemented well.
5. Construction Management Consultant (CMC) : Supervises the implementation of the project to ensure compliance with technical specifications and schedules. They play a vital role in maintaining the quality and safety of the project.
6. Sub Contractor : Performs specific work assigned by the main contractor. They are expected to follow the established standards.
7. Supplier : Provides the materials needed for the execution of the work. Their expectation is to ensure the availability of materials according to specifications.

In addition, five other stakeholders need information strategies, including the local community, bridge users, and regulators. These findings indicate that active involvement of all stakeholders is essential for the success of bridge maintenance projects.

4. Conclusion

Through a systematic approach based on PMBOK 6th edition, this study has successfully identified seven key stakeholders who require a collaborative engagement strategy, as well as five stakeholders who require an information provision strategy. This identification process was carried out carefully to ensure that each stakeholder has a clear role and well-defined expectations in the context of bridge maintenance and care. In achieving this goal, this study involved validation by experts who are experienced in the field of project management and infrastructure maintenance. This validation aims to ensure that the roles and responsibilities set are in accordance with project needs and can be implemented effectively.

The analysis results show that active involvement of stakeholders, including asset owners, contractors, consultants, and the community, is essential for the success of bridge maintenance. This involvement not only contributes to better decision-making, but also helps in identifying potential problems early on, so that they can be addressed before they develop into bigger issues. By involving all relevant parties, bridge maintenance projects can be implemented more efficiently and effectively, and reduce the risk of conflict that may arise due to stakeholder dissatisfaction.

The novelty obtained from this study includes the development of a Power-Interest Grid matrix used to map stakeholders based on their power and interests. This matrix provides deeper insight into the dynamics of relationships between various stakeholders, so that the project team can formulate a more focused and effective engagement strategy as shown in **Table 4**. In addition, this study found that imbalances in communication and coordination between stakeholders are often the main factors that

hinder the effectiveness of bridge maintenance . Therefore, the engagement strategy developed in this study not only includes identifying stakeholders but also adjusting their communication and engagement patterns based on their positions in the Power-Interest matrix. Furthermore, this study produces a stakeholder engagement implementation and monitoring plan that focuses on more effective coordination mechanisms, such as strengthening communication between stakeholders through regular discussion forums, increasing transparency in decision-making, and periodic evaluation of the effectiveness of stakeholder engagement. With this approach, the strategies implemented can be more responsive to project needs and can improve efficiency and effectiveness in bridge maintenance.

References

[1] J. D. Alamsjah, "Estimasi tahun konstruksi jembatan di Indonesia menggunakan analisis data satelit landsat," 2020, Accessed: Aug. 27, 2023. [Online]. Available: https://repository.unpar.ac.id/handle/123456789/repository.unpar.ac.id/handle/123456789/12609

[2] A. Muhammad Ridho Fakhrin, "Evaluasi Kelembagaan pada Pembangunan Infrastruktur Jalan Tol Trans Sumatera Berbasis Risiko untuk Meningkatkan Kinerja Waktu = Risk-Based Institutional Evaluation of Trans Sumatera Toll Road Infrastructure Development to Improve Time Performance," Universitas Indonesia Library. Accessed: Jul. 27, 2023. [Online]. Available: https://lib.ui.ac.id

[3] "Jumlah Jembatan Nasional | Open Data PUPR." Accessed: Aug. 27, 2023. [Online]. Available: https://data.pu.go.id/dataset/jumlah-jembatan-nasional

[4] P. Sriraj, B. Zou, L. Dirks, N. P. Farazi, and ..., "Maritime freight data collection systems and database to support performance measures and market analyses," *FHWA-ICT-20 …*, no. Query date: 2024-07-16 22:11:14, 2020, [Online]. Available: https://www.ideals.illinois.edu/items/116677

[5] B. GANI, "EVALUASI METODE 'BRIDGE MANAGEMENT SYSTEM' INDONESIA (Studi Kasus Jembatan Kabupaten Agam)," masters, Universitas Andalas, 2016. Accessed: Aug. 27, 2023. [Online]. Available: http://scholar.unand.ac.id/17349/

[6] F. Hariman, H. C. H, and A. Triwiyono, "EVALUASI DAN PROGRAM PEMELIHARAAN JEMBATAN DENGAN METODE BRIDGE MANAGEMENT SYSTEM (BMS) (Studi Kasus : Empat Jembatan Propinsi D.I. Yogyakarta)," *Civil Engineering Forum Teknik Sipil*, vol. 17, no. 3, pp. 581–593, 2007.

[7] J. Xue, G. Q. Shen, Y. Li, J. Wang, and I. Zafar, "Dynamic Stakeholder-Associated Topic Modeling on Public Concerns in Megainfrastructure Projects: Case of Hong Kong–Zhuhai–Macao Bridge," *Journal of Management in Engineering*, vol. 36, no. 6, p. 04020078, Nov. 2020, doi: 10.1061/(ASCE)ME.1943-5479.0000845.

[8] J.-H. Chen, M.-C. Su, S.-K. Lin, W.-J. Lin, and M. Gheisari, "Smart bridge maintenance using cluster merging algorithm based on self-organizing map optimization," *Automation in Construction*, vol. 152, p. 104913, Aug. 2023, doi: 10.1016/j.autcon.2023.104913.

[9] J. Yu, J. Huo, Q. Shi, G. Sheng, and H. Zhang, "An Exploration on the Organizational Structure Design of the Hong Kong-Zhuhai-Macao Bridge Authority," in *The 19th International Conference on Industrial Engineering and Engineering Management*, E. Qi, J. Shen, and R. Dou, Eds., Berlin, Heidelberg: Springer, 2013, pp. 975–985. doi: 10.1007/978-3-642-37270-4_93.

[10] N. Laksono, Y. T. Hasiholan, Y. Latief, and D. E. Saputro, "Pengembangan Standar Work Breakdown Structure (WBS) Pekerjaan Pemeliharaan dan Perawatan Struktur Atas Jembatan Beton Berbasis Risiko untuk Meningkatkan Kinerja Keselamatan Konstruksi," *Jurnal Teknik Sipil dan Lingkungan*, vol. 9, no. 1, Art. no. 1, Apr. 2024.

[11] A. D. Orcesi and C. F. Cremona, "A bridge network maintenance framework for Pareto optimization of stakeholders/users costs," *Reliability Engineering & System Safety*, vol. 95, no. 11, pp. 1230–1243, Nov. 2010, doi: 10.1016/j.ress.2010.06.013.

[12] J. Xue, G. Q. Shen, Y. Li, J. Wang, and I. Zafar, "Dynamic Stakeholder-Associated Topic Modeling on Public Concerns in Megainfrastructure Projects: Case of Hong Kong–Zhuhai–Macao Bridge," *J. Manag. Eng.*, vol. 36, no. 04020078, 2020, doi: 10.1061/(ASCE)ME.1943-5479.0000845.

[13] *Guide to the Project Management Body of Knowledge (PMBOK® Guide)–Sixth Edition*. Project Management Institute, 2017.

[14] A. Khan, M. Waris, S. Panigrahi, M. Sajid, and ..., "Improving the performance of public sector infrastructure projects: Role of project governance and stakeholder management," *Journal of Management …*, no. Query date: 2024-07-16 22:11:14, 2021, doi: 10.1061/(ASCE)ME.1943-5479.0000886.
[15] T. Loi, "Stakeholder management: a case of its related capability and performance," *Management decision*, no. Query date: 2024-07-16 22:11:14, 2016, doi: 10.1108/MD-06-2015-0244.
[16] A. J. C. Marinho and J. Couto, "Contribution to improvement of knowledge management in the construction industry - Stakeholders' perspective on implementation in the largest construction companies," *Cogent Engineering*, vol. 9, no. 1, 2022, doi: 10.1080/23311916.2022.2132652.
[17] A. Becker and M. Caldwell, "Stakeholder perceptions of seaport resilience strategies: A case study of Gulfport (Mississippi) and Providence (Rhode Island)," *Coastal Management*, no. Query date: 2024-07-16 22:11:14, 2015, doi: 10.1080/08920753.2014.983422.
[18] F. Schiavone, D. Mancini, D. Leone, and ..., "Digital business models and ridesharing for value co-creation in healthcare: A multi-stakeholder ecosystem analysis," *… Forecasting and Social …*, no. Query date: 2024-07-26 14:13:17, 2021, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0040162521000792
[19] L. Bourne, *Stakeholder relationship management: a maturity model for organisational implementation*. taylorfrancis.com, 2016. doi: 10.4324/9781315610573.
[20] "(PDF) Stakeholder Power-Interest Analysis of disaster insurance for public infrastructure in Semarang City," *ResearchGate*, Dec. 2024, doi: 10.14710/mkts.v26i2.32086.
[21] R. Goyal, M. J. Whelan, and T. L. Cavalline, "Multivariable Proportional Hazards-Based Probabilistic Model for Bridge Deterioration Forecasting," *J. Infrastruct. Syst.*, vol. 26, no. 2, 2020, doi: 10.1061/(ASCE)IS.1943-555X.0000534.