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THE EFFECT OF PROJECT COMMUNICATIONS MANAGEMENT ON PROJECT TIME PERFORMANCE

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ABSTRACT

The construction industry plays a significant role in the country, while project delays cause various problems. Regarding that, communication is very influential on the project performance, especially time performance. This study aims to identify the factors that affect project communications, identify the effect of project communications management on project time performance, and analyze project communications management strategies for improving time performance. The calculation of the Relative Importance Index was carried out to determine the factors that affect project communications. Meanwhile, a simple linear regression analysis was carried out to find out the magnitude of the effect of project communications management on project time performance. The project communications management strategy was obtained by mapping stakeholders using the power/interest grid method. The data was collected based on observations and the results of questionnaires filled out by 38 respondents, consisting of the owner, supervisor consultant, and contractor on the design-build project used as a case study. The results showed the top 10 factors influencing project communications with the highest Relative Importance Index value. The simple linear regression analysis result showed that project communications management has a positive and significant effect on project time performance with a coefficient of determination value of 69.6%. The suggested project communications management strategy is to optimize the application of the main factors of project communications, tailored to the result of the power/interest grid for each project stakeholder.

Keywords: Project communications management; Stakeholder; Time performance

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1. INTRODUCTION

Infrastructure development, especially the construction industry, plays a notable role in the state's sustainability. Currently, the government is committed to completing infrastructure projects no later than 2024 to avoid stalling (Heriyanto & Ihsan, 2022) (Office of Assistant to Deputy Cabinet Secretary for State Documents & Translation, 2022) (Gilang G. & Kenzu T., 2022). The inability to complete the project within the allotted time caused many corporate leaders to be fired (Kerzner, 2009). Settlement of work that is not on time is a lack of productivity rates. This certain will result in wastage of financing (Rauzana & Dharma, 2022). On the other side, communication is very significant in project management. According to research, top project

managers spend about 90% of their time on a project communicating (Project Management Institute, 2017). Zulch (2014) mentions that the project manager's communication skills affect project performance because of his role in integrating cost, quality, and scope to achieve product quality.

Effective communication bridges stakeholders with different organizational cultures and backgrounds, different skills, different skill levels, and different perspectives and interests, which can affect project implementation. Communication is the most significant factor in establishing effective stakeholder relationships (Project Management Institute, 2017). In particular, construction project stakeholders consist of the leading elements such as the owner, design consultant, supervisor consultant, and contractor (Marleno, Surjokusumo, Oetomo, Setiawan, & Abdullah, 2018). In mapping stakeholders, stakeholders will be categorized by methods such as the power/interest grid that groups stakeholders according to their level of power and level of interest in project outcomes (Project Management Institute, 2017). Project communications management is so helpful in facilitating the flow of communication between parties so that communication errors can be reduced (Nursin, Latif, Mochtar, & Soeparto, 2018). Based on *A Guide to the Project Management Body of Knowledge* (PMBOK), project communications management consists of three processes, namely: plan communications management, manage communications, and monitor communications (Project Management Institute, 2017).

The scientific literature shows that one of the keys to a successful project is effective communication. In Chen and Wu's research (2010), communication ranks first as a factor that affects project success. According to Aartsengel dan Kurtoglu (2013), communication ranks high among the factors that lead to project success. Communication has a significant effect on project success and performance, one of which is time performance (Zulch, 2014); (Shad, Shah, Jan, & Ahmad, 2019); (Setiawan, Hansen, & Fujiono, 2021). Meanwhile, communication disturbances cause problems such as project cost overruns, poor quality of work, waste, rework, decline in productivity, conflicts, disputes, claims, and delays in work time (Obonadhuze, Eze, Siunoje, & Sofolahan, 2021) (Hussain, Othman, Gabr, & Aziz, 2018) (Rahman & Gamil, 2019). Some adverse effects of communication failure above are related to a degradation in time performance.

According to the Project Management Institute (2021), project time performance can be measured by schedule variance and schedule performance index to assess the magnitude of deviations for the original baseline schedule. Time performance with schedule deviation is the process of comparing the actual schedule with the planned schedule (Vaibhava, Rao, Shetty, & Prakash, 2020).

The objectives of this study include: identifying the factors that influence communication on the project; identifying the effect of project communications management on the project time performance; and analyzing project communications management strategies to improve time performance. The benefits of this research are for educational institutions to enrich knowledge and as a reference source for further research; and for the construction industry to provide input for practitioners on project communications management in improving time performance.

2. METHODS

2.1 Objects and Location of the Research

The research was conducted on a building project that adheres to a *design and build* system in Depok, West Java, Indonesia.

2.2 Population and Sample of the Research

The population used is all project stakeholders. Sampling is done by purposive sampling, which uses specific considerations (Ames, Glenton, & Lewin, 2019). The sample criteria in this study are employees of leading element stakeholders of construction projects who are carrying out work in the project environment and are willing to be respondents. Thus, the number of samples obtained is 38 respondents.

2.3 Research Variable

The independent variables of this study are the project communications management factors described in the PMBOK; the dependent variable of this research is time performance with the indicators described above (Project Management Institute, 2017) (Project Management Institute, 2021).

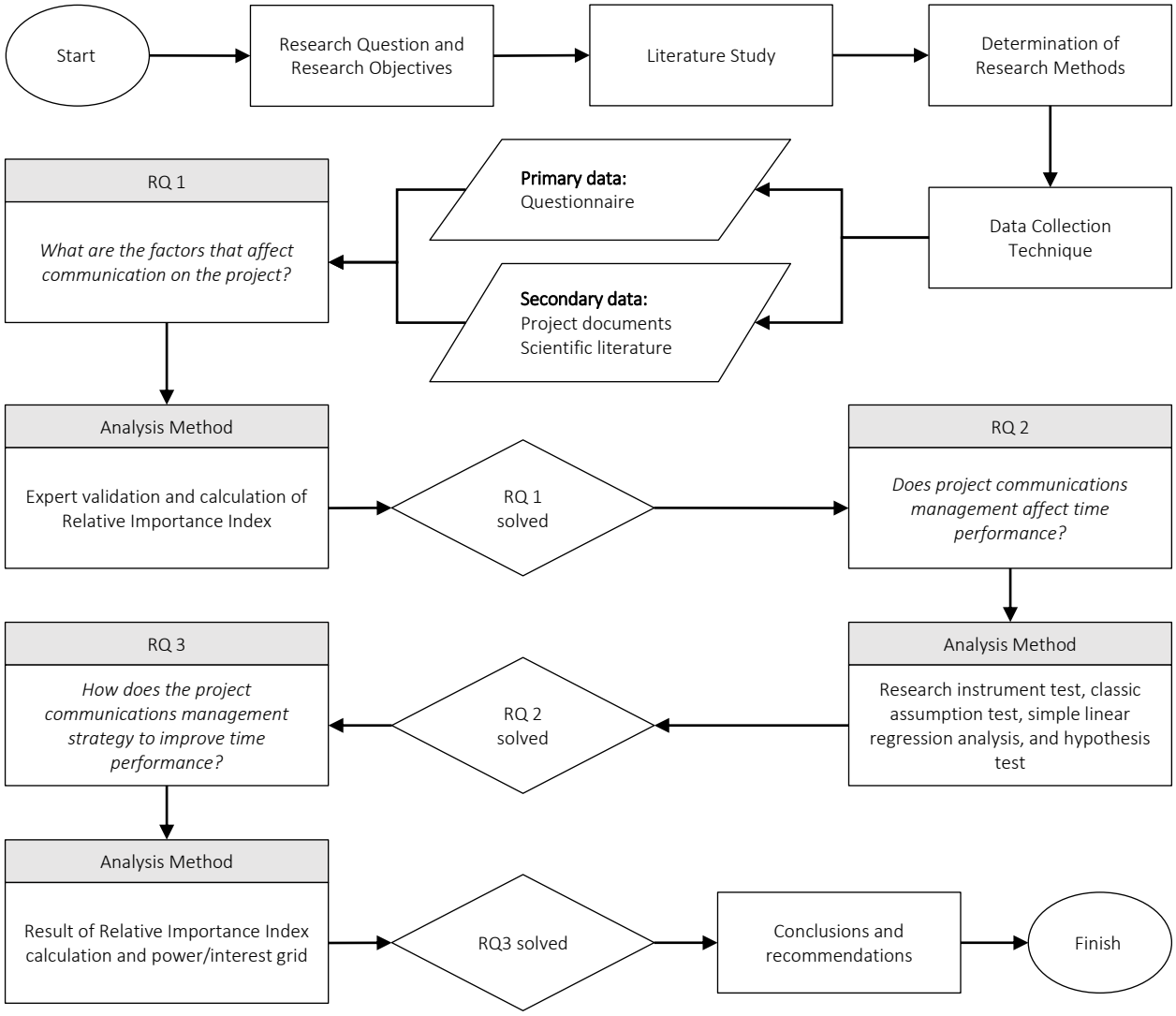

Figure 1. Research Flow Chart

2.4 Data Collection Technique

Questionnaires were distributed to employees of the contractor, owner, and project consultant. Meanwhile, the measurement scale used is the *Likert* scale (Taherdoost, 2019).

2.5 Data Analysis Method

2.5.1 Relative Importance Index

To rank the factors that affect project communications, the *Relative Importance Index* (RII) analysis method is used. The RII value is obtained based on the calculation of each factor or statement based on the respondents' answers and calculated by the following equation (Tholibon, et al., 2021).

$$RII_i = \frac{n_1+2n_2+3n_3+4n_4+5n_5}{5(n_1+n_2+n_3+n_4+n_5)} \quad (1)$$

2.5.2 Research Instrument Test

A validity test is helpful to measure the validity of a questionnaire. According to the Pearson Product Moment correlation technique, if the correlation coefficient (r_{count}) is more than r_{table}, the element tested is declared valid (Cohen, Manion, & Morrison, 2018). A reliability test is helpful to measure a questionnaire that is an indicator of a variable. The research instrument will be declared reliable if *Cronbach's Alpha* value is more than 0.6 (Cohen, Manion, & Morrison, 2018).

2.5.3 Classic Assumption Test

The normality test aims to test whether, in the regression model, the residual variables have a normal distribution. According to the Kolmogorov-Smirnov non-parametric statistical test, the residuals are normally distributed if they have a significance value of more than 0.05 (Cohen, Manion, & Morrison, 2018). The linearity test aims to test whether the model specifications used are correct or not correct. If the *deviation from linearity value* is more than 0.05, then there is a linear relationship between the variables (Cohen, Manion, & Morrison, 2018). The heteroscedasticity test aims to test in the linear regression model whether there is an inequality of variance from the residuals from one observation to another observation. According to the *Glejser* test, if the probability value is more than 0.05, thus there is no heteroscedasticity (Cohen, Manion, & Morrison, 2018); (Kin, Oki, & Rai, 2020).

2.5.4 Simple Linear Regression Analysis

Simple linear regression analysis is based on a functional or causal relationship of one independent variable with one dependent variable (Cohen, Manion, & Morrison, 2018). The regression equation model of this study is as follows.

$$Y = \alpha + \beta X \quad (2)$$

2.5.5 Hypothesis Test

A partial test aims to measure how far the influence of the independent variable is in explaining the variation of the dependent variable. The alternative hypothesis is acceptable if the significance value is less than 0.05 (Cohen, Manion, & Morrison, 2018). The coefficient of determination (R^2) aims to measure how far the ability of the model to explain the variation of the dependent variable (Chicco, Warrens, & Jurman, 2021).

2.5.6 Power/Interest Grid

The power/interest grid is one method for mapping stakeholders (Project Management Institute, 2013). The calculation of the power/interest grid is carried out based on the results of the questionnaire in the section on project stakeholder mapping. The average value (mean) of respondents' assessment of the power and interest of each project stakeholder becomes the result of the calculation. Furthermore, the calculation results are presented as a Cartesian diagram (power/interest grid) (Dos Muchangos, Tokai, & Hanashima, 2017).

3. RESULTS AND DISCUSSION

3.1 Data Collection

Based on observations, the project under review experienced work delays and underwent some contract amendments related to additional implementation time. As a project that adheres to a design and build system, communications become prominent with various relevant stakeholders. The data from the questionnaire were obtained from 38 respondents consisting of elements of the contractor, owner, and supervisor consultant as shown in table 1 and figure 2.

Table 1. Respondent Data

Institution	Frequency	Percentage
Contractor	26	68.42%
Owner	6	15.79%
Supervisor Consultant	6	15.79%
Total	38	100.00%

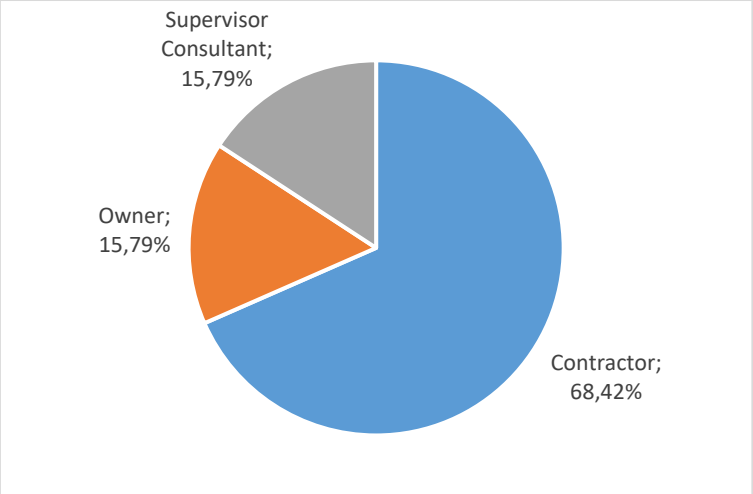

Figure 2. Respondent Data by Institution

3.2 Factors Affecting Project Communications

A relative Importance Index (RII) calculation is carried out to determine the factors that affect project communication. The RII value is obtained from the calculation result of the respondents' assessment to rank the predetermined factors contained in project communications management.

Table 2. RII Calculation Results

Statement	Respondent Assessment					RII
	1	2	3	4	5	
Plan Communications Management						
X.1	0	0	5	19	14	0,847
X.2	0	0	1	21	16	0,879
X.3	0	0	4	25	9	0,826
X.4	0	2	13	21	2	0,721

Statement	Respondent Assessment					RII
	1	2	3	4	5	
X.5	0	1	18	16	3	0,711
X.6	0	0	2	23	13	0,858
X.7	0	0	3	16	19	0,884
X.8	0	0	3	19	16	0,868
X.9	0	0	2	20	16	0,874
X.10	0	0	5	23	10	0,826
Manage Communications						
X.11	0	0	2	19	17	0,879
X.12	0	0	1	12	25	0,926
X.13	0	0	2	27	9	0,837
X.14	0	0	8	19	11	0,816
X.15	0	0	5	20	13	0,842
X.16	0	0	2	20	16	0,874
X.17	0	0	4	24	10	0,832
X.18	0	0	8	15	15	0,837
X.19	0	0	2	24	12	0,853
X.20	0	0	4	18	16	0,863
X.21	0	0	3	18	17	0,874
X.22	0	0	3	25	10	0,837
X.23	0	0	0	24	14	0,874
X.24	0	0	6	22	10	0,821
X.25	0	1	3	12	22	0,889
Monitor Communications						
X.26	0	0	9	19	10	0,805
X.27	0	0	1	17	20	0,900
X.28	0	0	5	28	5	0,800
X.29	0	0	17	16	5	0,737
X.30	0	0	12	15	11	0,795
X.31	0	0	12	22	4	0,758
X.32	0	0	8	19	11	0,816
X.33	0	0	4	20	14	0,853
X.34	0	0	5	19	14	0,847
X.35	0	1	4	15	18	0,863
X.36	0	0	1	23	14	0,868
X.37	0	1	7	21	9	0,800
X.38	0	0	9	21	8	0,795

Based on Table 2, the top 10 factors that affect project communication related to time performance are obtained as shown in Table 3.

Table 3. RII Rank

	Statement	RII
X.12	Work Performance Reports	0,926
X.27	Work Performance Data	0,900
X.25	Organizational Process Assets Updates	0,889
X.7	Communication Models and Interpersonal and Team Skills	0,884
X.2	Project Documents	0,879
X.11	Project Management Plan and Project Documents	0,879
X.9	Communications Management Plan	0,874
X.16	Communication Skills	0,874

	Statement	RII
X.21	Interpersonal and Team Skills	0,874
X.23	Project Communications	0,874

Based on these rankings, it is known that: 6 factors are part of the manage communications process; 3 factors are part of the plan communications management process; 1 factor is part of the monitor communications process.

Based on the results of RII calculations, the work performance reports ranked first at 0.926. This case shows that performance reports need to contain the status, progress, and changes of work that are distributed to project stakeholders clearly and periodically. Work performance data ranked second at 0.900. This case shows that work performance data need to be updated regularly. This data can explain the tier of the project performance of the cost, quality, and time. Organizational process assets updates ranked third at 0.889. This case shows the importance of organizational process assets such as project notes (letters, memos, meeting minutes, and other documents) and project reports and presentations to be kept up to date as a result of communications management activities. Communication models and interpersonal and team skills ranked fourth at 0.884. This case shows that planning and implementing the project, the communication style skills required such as the method, format, and content selected, and the adjustment of the project communications strategy. The project documents ranked fifth at 0.879. This case shows the importance of documents describing project stakeholders to determine the roles and requirements of stakeholders and their proper placement. The project management plan and project documents ranked sixth at 0.879. This case shows the importance of resource planning for managing the project team, communication within the project, communication strategy with stakeholders, and the completeness of technical documents, lessons learned, and change orders. The communications management plan ranked seventh at 0.874. This case shows the significance of a communications management plan that includes arrangements related to the distribution of information; in this matter are procedures and forms that have been implemented in the project. Communication skills ranked eighth at 0.874. This case shows that communication skills have a significant role in synergizing between construction project stakeholders. Interpersonal and team skills ranked ninth at 0.874. This case shows the importance of using interpersonal skills applied in the implementation coordination relationship between project stakeholders. Project communications ranked tenth at 0.874. This case shows that with good communications management, stakeholder requirements are fulfilled, regarding the completeness of performance reports, the status of achievements, progress of work, costs incurred, presentations, and other information.

3.3 The Effect of Project Communications Management on the Project Time Performance

Based on the validity test result, it appears that the value of r_{count} for each statement item on the X and Y variables is more than r_{table} (0.329); then can be concluded that all statement items are declared valid. Based on the reliability test, the value of *Cronbach's Alpha* on each variable is more than 0.6; then can be concluded that all variables are reliable.

Table 4. Result of Normality Test

One-Sample Kolmogorov-Smirnov Test		Unstandardized Residual
N		38
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	1.34840389
Most Extreme Differences	Absolute	.124
	Positive	.124
	Negative	-.075
Test Statistic		.124
Asymp. Sig. (2-tailed)		.149[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The normality test results in Table 4 show the value of *Asymp. Sig (2-tailed)* of 0.149 is more than 0.05; then, the research data has distributed normally.

Table 5. Result of Linearity Test

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Y * X	Between Groups	(Combined)	199.728	24	8.322	4.993	.002
		Linearity	154.122	1	154.122	92.473	.000
		Deviation from Linearity	45.606	23	1.983	1.190	.382
	Within Groups		21.667	13	1.667		
	Total		221.395	37			

The linearity test results in Table 5 show the Deviation from Linearity value of 0.382, which is more than 0.05; then, there is a linear relationship between the variables.

Table 6. Result of Heteroscedasticity Test

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model	B	Std. Error	Beta		
1 (Constant)	2.451	1.095		2.239	.031
X	-.008	.007	-.193	-1.180	.246
a. Dependent Variable: ABS_RES					

The heteroscedasticity test results in Table 6 show the Sig. value of 0.246 is more than 0.05 on variable X; then, there are no symptoms of heteroscedasticity.

Table 7. Result of Simple Linear Regression Analysis

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model	B	Std. Error	Beta		
1 (Constant)	-.427	2.309		-.185	.854
X	.131	.014	.834	9.082	.000
a. Dependent Variable: Y					

Based on the simple linear regression analysis results in Table 7, the regression equation Y = -0.427 + 0.131 X. This case means that if the independent variable (project communications management) changes by one unit, then the dependent variable (time performance) will transform by 0.131. A positive coefficient indicates that project communications management has a positive effect on project time performance. If project communications management increases by one unit, time performance will increase by 0.131.

The partial test results in the Table 7 show the value of Sig. on variable X (project communications management) of 0.000 is less than 0.05; then, there is a significant influence of project communications management on project time performance.

Table 8. Result of Coefficient of Determination

Model Summary[b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.834[a]	.696	.688	1.367
a. Predictors: (Constant), X				

The analysis of the coefficient of determination results in Table 8 show a value of 0.696. This case means that 69.6% of the dependent variable, namely time performance, is influenced by the independent variable, namely communications management. Meanwhile, the remaining 30.4% is explained by other variables not included in this study.

3.4 Project Communications Management Strategies to Improve Time Performance

Table 9. Result of Stakeholder Power/Interest Calculation

Stakeholder	Interest	Power	Description
Owner	4,763	4,789	Manage Closely
Design Consultant	4,158	4,105	
Supervisor Consultant	4,553	4,289	
Contractor	4,789	4,132	
Subcontractor	3,816	2,868	Keep Informed
Vendor/Supplier	3,711	2,737	
Railway Manager	3,553	3,816	Manage Closely
User	3,684	2,947	Keep Informed
Local Community	2,289	2,526	Monitor
General Public	2,211	2,263	
Community Organization	2,158	2,158	
Mass Media	2,316	2,132	
Central/Local Government	2,842	3,763	Keep Satisfied
Financial Institution	3,474	3,737	Manage Closely
Business Partner	3,789	3,211	

The calculation of the power/interest grid is carried out based on the results of the questionnaire in the section on project stakeholder mapping. The calculation results are obtained based on the average value (mean) of respondents' assessment of the level of power and level of interest of each project stakeholder as shown in Table 9.

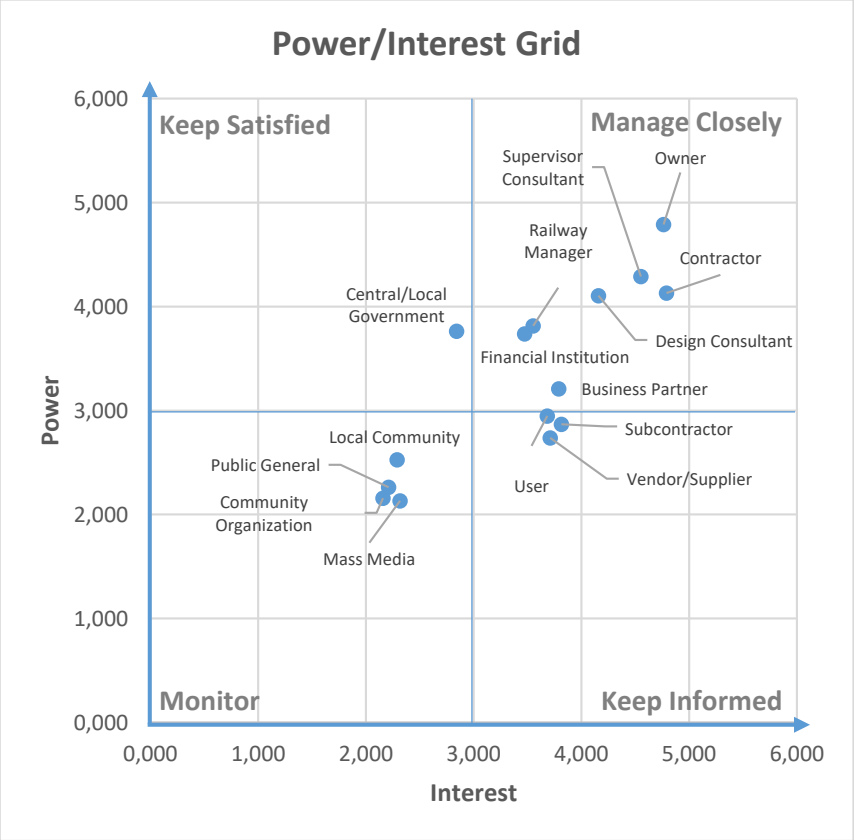

Figure 3. ***Power/Interest Grid***

For improving time performance, the suggested project communications management strategy is to optimize the application of the top project communication factors that have been obtained. However, it is necessary to adjust the strategies based on the power/interest grid results in Figure 3 and the description in Table 10.

Table 10. Communicatons Strategy

Communications Management Factors	Stakeholder	Power/ Interest	Strategy	Method	Time
• Preparation and distribution of work performance reports • Compilation of work performance data • Notes, reports, and presentation updates • Improving communication style skills and cultural awareness • Preparation of documents related to stakeholders • Completeness of project management plan and project documents • Preparation of communications management plan	Owner	*Manage Closely*	Engage in project activities and communicate intensely	Interactive (meetings), *push* (written, reports)	During the project, on request (periodically)
	Design Consultant			Interactive (meetings), *push* (written, e-mails)	During the project, as needed
	Supervisor Consultant			Interactive (meetings), *push* (written, reports)	During the project, on request (periodically)
	Contractor				
	Railway Manager			Interactive (meetings), *push* (written, letters)	During the project, as needed
	Financial Institution				
	Business Partner			Interactive	
	Subcontractor				

Communications Management Factors	Stakeholder	Power/ Interest	Strategy	Method	Time
• Improving communication skills • Improving inter-stakeholder coordination relationship • Smooth project communications	Vendor/Supplier	*Keep Informed*	Provide sufficient information and ensure that no problems occur	Interactive (meetings), *push* (written)	During the project
	User			*Push* (information notification)	
	Central/Local Government	*Keep Satisfied*	Communicate informatively and persuasively to maintain satisfaction	Push (written)	As required
	Local Community	*Monitor*	Just monitor and communicate minimally	*Pull* (general information), interactive (dialogue)	If needed
	Community Organization				
	General Public			*Pull* (general information)	
	Mass Media			*Pull* (general information), interactive (interview)	

Stakeholders included in the manage closely quadrant are the owner, design consultant, supervisor consultant, contractor, railway manager, financial institution, and business partners. Then, the strategy taken is to involve these stakeholders in project activities and communicate intensely. The activities carried out are to: inform reports and project performance data periodically and on-demand; collaborate in regular meetings with communication skills; engage in discussions related to change; request input and submit project documents as needed; carry out project communications according to procedures; perform coordination supported by communication skills.

Stakeholders included in the keep informed quadrant are the subcontractor, vendor/supplier, and user. Then, the strategy taken is to: provide sufficient information to these stakeholders and ensure there are no problems. The activities carried out are to: periodically inform project performance reports and data; engage in discussions related to change; carry out project communications according to procedures; and perform coordination supported by communication skills; while for the user is to convey some project-related information during the project.

Stakeholders included in the keep satisfied quadrant are the central/local government. Then, the strategy taken is: to communicate with these stakeholders in an informative and persuasive manner to maintain their satisfaction. The activities carried out are to inform project performance reports and data in the form of a final report; request input and submit project documents as needed; perform coordination supported by communication skills; convey general project-related information.

Stakeholders included in the monitor quadrant are the local community, the general public, community organization, and mass media. Then, the strategy taken is: to monitor and communicate with these stakeholders minimally. The activities carried out are sufficient to provide general information when needed.

4. CONCLUSION

Based on the research objectives and results, there are 3 conclusions of this study. The top 10 main factors influencing project communications include: work performance reports; work performance data;

organizational asset updates; communication models and interpersonal and team skills; project documents; project management plan and project documents; communications management plan; communication skills; interpersonal and team skills; and project communications. Project communications management has a positive and significant effect on project time performance; the influence of project communications management on project time performance is strong enough, namely 69.6%. The recommended project communications management strategy for improving time performance is to optimize the application of factors that affect project communications according to the respondents' assessments results of the stakeholder power/interest grid.

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