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Factors Influencing the Performance of Department of Public Works and Highways Field Engineers: Input for Supervisory Project Management Plan

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Abstract. The Department of Public Works and Highways (DPWH) plays a critical role in shaping infrastructure projects in the Philippines, with field engineers at the forefront of any project execution. This study was conducted to determine the factors influencing the performance of field engineers at the DPWH, considering the individual, team, and organizational factors. Using a descriptive-correlational research design, the study was conducted at DPWH Eastern Samar District Engineering Office, with 30 field engineers who served as the respondents. Mean and standard deviation were used to analyze the data, while Pearson's correlation was used to test the hypothesis. The key findings revealed that factors such as technical skills (r=0.306), experience (r=0.162), and motivation (r=0.332) have nothing to do with performance, with p-values higher than 0.05. On a team level- leadership and management (r=0.407) are critical to success. Sufficient resource allocation (r=0.356) drives better performance at the organizational level. The research stressed the importance of providing continuous professional development to field engineers to enhance their technical know-how and leadership capabilities. Likewise, supportive leadership that fosters collaboration and communication among teams is vital to achieving project goals. On an organizational scale, efficient resource management and well-defined policies are necessary for field engineers to perform effectively and efficiently. It is suggested that to improve project outcomes, the DPWH should implement targeted training programs, foster leadership that encourages teamwork, and ensure adequate resource distribution. Also, refining organizational policies can help create a more structured and supportive environment for field engineers to improve individual and team performance and ensure efficient use of resources, ultimately enhancing infrastructure development in the Philippines.

Keywords: Field engineers; Organizational factors; Performance factors; Supervisory project management; Transformational leadership.

1.0 Introduction

The Department of Public Works and Highways (DPWH) is a government agency in the Philippines that has been instrumental in transforming the country's infrastructure by managing the planning, development, and upkeep of numerous public works projects across the Philippines. Accordingly, field engineers are entrusted with the role of overseeing specialized capacities, testing hardware, taking care of repairs, overseeing building projects, and conducting location assessments. They spend a small percentage of their time at an office (Thomas & Bhaumik, 2023), and they spend the larger part observing and assessing workers and machines on the field. Their essential objective is to advance in general effectiveness and efficiency in their work environment (Cen et al., 2021).

Furthermore, utilizing specialized expertise to solve and resolve issues related to gear and systems. However, while there is existing literature regarding factors influencing the performance of field engineers in different manufacturing industries, limited studies focus on DPWH. Thus, this study was conducted to understand the different factors that influence the performance of DPWH field engineers. Johnson (2024) indicated the need to conduct a study relative to field engineers' performance to identify areas for training strategies, as inefficient training strategies may impact how field engineers effectively contribute to organizational success. Additionally, Bunner et al. (2019) speculated in their study the essence of understanding how field engineers perform their roles for developing effective performance metrics. They indicated that management support and feedback mechanisms play a significant role in improving their job performance.

The field engineer role is critical to project implementation success (Chan et al., 2019). Dacanay et al. (2023) opined that the performance of field engineers plays a pivotal role in the successful implementation of projects undertaken by the Department of Public Works and Highways (DPWH). Factors influencing the performance of DPWH field engineers, including individual, team, and organizational factors, are crucial for enhancing project outcomes and ensuring efficient resource utilization. The role of individual factors in influencing engineer performance in project implementation is a complex interplay of technical proficiency, experiential knowledge, and intrinsic motivation. Each of these elements contributes uniquely to the overall effectiveness and success of engineering projects, from foundational infrastructure developments to cutting-edge technological constructions.

The growing body of research on this subject, both in the Philippines and in various international contexts, offers a solid foundation for comprehending at the heart of an engineer's ability to contribute to a project effectively is their technical skillset and depth of knowledge. This encompasses the basic competencies acquired through formal education and the advanced proficiencies developed through continued professional engagement and learning. Watts (2024) emphasizes the importance of continuous skill development and knowledge acquisition for improving job performance, a concept especially relevant in the fast-paced and constantly changing engineering field. This perspective is reinforced by Qi et al. (2024), who argue for the indispensable value of continuous professional development programs in equipping engineers with the latest technological insights and standards, directly influencing engineering projects' success. The complex aspects of engineer performance in project implementation (Homthong et al., 2024).

It was revealed by Lim and De Guzman (2020) that motivational factors such as recognition, achievement, and personal growth are pivotal in driving engineers' commitment and productivity in project execution. This body of work highlights the universal truth that motivation and attitude are indispensable in fostering high-performing engineering professionals capable of successfully progressing projects. Most companies are reliant on their teams for creativity and productivity. They enhanced the team's performance by knowledge sharing (Vrontis et al., 2020). The research of Nyfoudi et al. (2022) concluded that knowledge sharing mediates the relationship between managerial skill and team performance, especially when the learning goal of the manager is higher.

Moreover, the foundational work of Saebah and Merthayasa (2024) on organizational culture posits that the underlying beliefs, values, and principles that constitute an organization's cultural fabric significantly influence its members' behaviors and attitudes, including their approach to project implementation. This perspective has been corroborated by numerous studies, such as Mensah (2019), Srisathan et al. (2020), and Akanji et al. (2020), demonstrating the profound impact of organizational culture on the performance of engineering projects. An investigation made by Zhang et al. (2018) found that flatter organizational structures facilitate better communication and collaboration among project team members, thereby improving project performance—a finding that resonates with the experiences of Philippine engineering projects (Cruz, 2018).

Similarly, Shakeri and Khalilzadeh (2020) underscore the importance of resource availability and organizational backing in achieving project objectives. This is particularly relevant in the engineering context, where the complexity and scale of projects demand substantial resources and robust support mechanisms. Studies conducted by Santos (2019) revealed that effective resource allocation and comprehensive support systems significantly enhance the efficiency and outcomes of engineering projects. This finding is mirrored in international research by Zwikael et al. (2012), who noted the positive impact of adequate resource provisioning and organizational support on project success rates across different countries. These insights collectively highlight the critical role of resource allocation and organizational support in enabling field engineers to perform optimally and deliver projects successfully.

The performance of engineers in public works and infrastructure transcends traditional productivity metrics, requiring a nuanced understanding of the socio-technical systems within which engineers operate. This understanding is premised on integrating social, technical, and environmental factors that collectively influence project outcomes Josa & Aguado (2019). In the Philippines, for instance, the emphasis on technical competence is complemented by a growing recognition of soft skills such as teamwork, communication, and leadership (Mufaricha et al., 2021). Additionally, international studies have underscored the importance of socio-technical competencies in navigating the complexities of infrastructure projects, which are often subject to varying degrees of uncertainty and risk. These studies emphasize the need for field engineers in the Department of Public Works and Highways to possess diverse skills beyond technical knowledge, including effective communication, problem-solving abilities, and adaptability to changing circumstances. Furthermore, studies like Quezon and Ibanez (2021) have identified the impact of management factors on the performance of field engineers. Furthermore, Nejatyan et al. (2023) highlighted that project management performance and the application of value engineering strategies are key factors affecting the performance of DPWH field engineers.

Thus, this study was conducted to identify factors influencing the performance of DPWH field engineers for enhancing project outcomes and ensuring efficient resource utilization to maximize project success rates and minimize delays and cost overruns to create specialized training programs, performance management systems, and organizational policies designed to enhance the skills and effectiveness of DPWH field engineers. Specifically looking at the individual, team, and organizational factors and their relationship to the performance of the DPWH field engineers.

2.0 Methodology

2.1 Research Design

For this investigation, the researchers used a descriptive-correlational research design. The design is suited to the study as it aims to explore and describe the myriad of factors traversing individual, team, and organizational dimensions that influence the performance of field engineers of DPWH. Also, it captures a broad spectrum of data across different dimensions of interest while ensuring consistency and comparability among responses. The descriptive-correlational approach allows for a comprehensive examination of the status quo, illuminating the existing conditions and relationships among the variables of interest. It will not only facilitate identifying and describing the key factors affecting field engineer performance but also enable the assessment of the relative importance of analyzing how these factors interrelate and impact field engineers' performance.

2.2 Research Locale

Selecting an appropriate research locale was paramount in ensuring the relevance and applicability of the study's findings. The Eastern Samar District Engineering Office (ESDEO) was chosen as the study setting for this investigation. It is a first-class district engineering office of DPWH Region VIII that implements a high volume of projects. The office is committed to implementing quality infrastructure and new technology with the goal of providing better service to its stakeholders.

2.3 Research Participants

The study's respondents are field engineers from the Department of Public Works and Highways (DPWH) of Eastern Samar. The chosen thirty (30) respondents were composed of Project Engineers (PE), Materials Engineers (ME), and Project Inspectors (PI) who were actively engaged in project implementation within the Eastern Samar District Engineering Office (ESDEO). Since the number of field engineers in the DPWH Eastern Samar district office is quite manageable, the researchers used the complete enumeration of samples. This method entails selecting all members of the defined population, allowing the researcher to gain comprehensive information without biases in smaller sample sizes (Scherer et al., 2006).

2.4 Research Instrument

A structured survey questionnaire was used as the primary data collection tool. The questionnaire comprised the categories under investigation, such as individual factors, adopted from Cordeiro et al. (2020), while the team factors were from Snider et al. (2017). It was adopted by Chow and Liu (2013) for organizational factors. This segmented approach facilitated a comprehensive examination of the variables pertinent to the study, ensuring that each area of interest was thoroughly addressed. Each indicator has five (5) questions, with 15 questions slightly modified to suit the current study.

A Likert-scale item was employed to measure the respondents' perceptions and experiences concerning the different factors. This choice was predicated on the need for a quantifiable and standardized means of capturing the intensity of respondents' feelings or attitudes toward the variables in question. Likert scales, with their graded response options, provided the nuanced spectrum necessary for this analysis, ranging from strong disagreement to strong agreement or similar gradations of frequency or quality. This methodological choice enhances the study's ability to conduct detailed statistical analysis, allowing for assessing correlations, differences, and trends within the collected data. The research instrument was validated through content validity by experts, including the District Engineer of ESDEO, the Faculty of Civil Engineering program, and research experts in the engineering field, who reviewed it for relevance and clarity of the items. The feedback from the evaluators was used to refine the instrument. The systematic validation ensured the instrument's appropriateness for the research objectives and target population. The Individual Performance Commitment and Review (IPCR) ratings were utilized as a reference for measuring field engineers' performance.

2.5 Data Gathering Procedure

The data-gathering process was pivotal to the success of any quantitative study, requiring meticulous planning and execution to ensure the data's integrity and quality of the collected data. For this study, a systematic procedure was implemented, adhering to ethical standards and operational considerations. The initial step involved obtaining ethical approvals and permissions from the institution and the DPWH. This step was crucial for ensuring compliance with ethical standards and facilitating access to the target population of field engineers. With the requisite approvals, the researcher distributed the questionnaires to the selected field engineers, employing strategies to maximize reach and engagement. Participants were provided with comprehensive information regarding the study's objectives, the confidentiality of their responses, and their autonomy in participation, including the right to withdraw at any time.

A combination of direct distribution and follow-up strategies was employed to achieve a high response rate. Follow-ups, conducted through respectful reminders and engagement efforts, were crucial in mitigating non-response and ensuring that a representative sample was achieved. Completed questionnaires were systematically collected, with measures in place to maintain data integrity and confidentiality throughout the process. To gather data on the performance of DPWH field engineers, a written request for a copy of the respondents' performance commitment and review (IPCR) ratings was addressed to the District Engineer of ESDEO.

2.6 Ethical Considerations

Ethical considerations are considered in the study to ensure that the participant's rights, safety, and well-being are protected. The respondents were provided with informed consent indicating the purpose of the study, procedures, risks, and benefits, and voluntarily agreed to participate. Moreover, the researchers adhere to confidentiality principles in protecting the participants' identities by securing the data privately. The researchers uphold the utmost integrity by conducting the study honestly and transparently, avoiding data manipulation, and ensuring the findings are reported accurately.

3.0 Results and Discussion

3.1 Factors Influencing Performance

Individual Factors

The result presented in Table 1 highlights the three key individual factors, namely Technical Skills, Experience and Qualifications, and Motivation and Attitude. Among the different factors, motivation and attitude obtained the highest mean score of 4.65, interpreted as highly influential. It is perceived as the most influential factor, with an SD value of 0.59, signifying a moderate response variability.

Table 1. Descriptive statistics of individual factors influencing DPWH field engineers' performance

Indicators	Mean	SD	Interpretation
Technical Skills	4.51	0.55	Highly Influential
Experience and Qualifications	4.51	0.63	Highly Influential
Motivation and Attitude	4.65	0.59	Highly Influential
Grand Mean	**4.56**	**0.59**	**Highly Influential**

Legend: 4.21-5.00- Highly Influential, 3.41-4.20- Influential, 2.61-3.40- Moderately Influential, 1.81-2.60- Slightly Influential, 1.00-1.80 – Not Influential

This implies that although most respondents rated this factor highly, there is some variation in how influential they consider it. Some might have rated it lower, though the consensus remains high, which suggests differences in individual experiences or contexts where motivation and attitude are perceived with slightly differing levels of importance. Being on the first rank further emphasizes the critical role of motivation and positive attitudes in the performance of field engineers. Meanwhile, the Technical Skills, Experience, and Qualifications shared the same mean rating of 4.51, indicating they are also considered highly influential. The standard deviation values of 0.55 and 0.63 suggest that the respondents' responses were consistent for Technical Skills, while there was more variability in how Experience and Qualifications were rated. Moreover, it also suggests that perceptions of the importance of experience and qualifications are more subjective and might be influenced by specific workplace environments, industries, or personal experiences.

The grand mean of 4.56 posits that all individual factors are seen as "Highly Influential," with moderate variability across responses having the average SD value of 0.59. This further suggests that while there is a consensus, respondents show some diversity in prioritizing the three factors, particularly regarding Experience and Qualifications, where variability is highest. The results further suggest that while technical expertise and experience are important, an individual's motivation and attitude are the most critical components influencing outcomes for field engineers.

Team Factors

The analysis provided in Table 2 is relative to team factors. It is highlighted that Communication & Collaboration ranks the highest, with a mean score of 4.67 with an interpretation of "Highly Influential," stressing that it is the most influential factor in team factors. The standard deviation value of 0.49 signifies a consistent response, emphasizing the essential role of effective communication and teamwork in driving team performance. Leadership and management styles are followed closely, with a mean score of 4.53 and a higher variability of SD value of 0.63, indicating that while leadership is highly influential, perceptions may differ depending on the leadership style experienced. While Conflict Resolution & Cohesion has the lowest mean score of 4.30 and a standard deviation score of 0.68, suggesting that while it remains highly influential, opinions on its importance vary the most.

Table 2. Descriptive statistics of team factors influencing DPWH field engineers' performance

Indicators	Mean	SD	Interpretation
Communication & Collaborations	4.67	0.49	Highly Influential
Leadership & Mgt. Styles	4.53	0.63	Highly Influential
Conflict Resolution & Cohesion	4.30	0.68	Highly Influential
Grand Mean	**4.50**	**0.60**	**Highly Influential**

Legend: 4.21-5.00- Highly Influential, 3.41-4.20- Influential, 2.61-3.40- Moderately Influential, 1.81-2.60- Slightly Influential, 1.00-1.80 – Not Influential

The grand mean score of 4.50 across all team factors confirms that each is viewed as highly influential, with a moderate variability of SD value of 0.60. Generally, the result indicates that communication and collaboration are considered the most crucial contributors to team success, followed by leadership. At the same time, conflict resolution, though significant, is slightly less impactful compared to other indicators. These elements are essential for fostering a cohesive and high-performing team environment, which is critical for successfully implementing engineering projects. The findings resonate with the broader literature on teamwork and leadership in engineering, highlighting the need for ongoing focus on these areas to enhance project outcomes (Kozlowski & Ilgen, 2006; Leveson et al., 2011).

Organization Factors

Looking at the result for organizational factors as shown in Table 3, the Organizational Culture and Structure indicator obtained the highest rank, with a mean score of 4.53 with an interpretation as "Highly Influential," indicating that it is the most influential factor among the different indicators. Respondents viewed the organization's values, environment, and structure as crucial to its overall performance. The standard deviation value of 0.62 showed moderate response variability, suggesting differences in how this factor is perceived. On the other hand, Policies & Procedures followed closely with a mean score of 4.49, which is also considered highly influential and ranked second. The lower variability of the SD value of 0.59 indicates a more consistent perception of the importance of clear policies and procedures in guiding organizational behavior and ensuring efficiency. The Resource Allocation & Support is also rated as "Highly Influential" but got the lowest mean score of 4.23 and an SD of 0.68, expressing that the respondents have more varied experiences with resources and support across the organization.

Table 3. Descriptive statistics of organizational factors influencing DPWH field engineers' performance

Indicators	Mean	SD	Interpretation
Organizational Culture & Structure	4.53	0.62	Highly Influential
Resource Allocation & Support	4.23	0.68	Highly Influential
Policies & Procedures	4.49	0.59	Highly Influential
Grand Mean	**4.42**	**0.60**	**Highly Influential**

Legend: 4.21-5.00- Highly Influential, 3.41-4.20- Influential, 2.61-3.40- Moderately Influential, 1.81-2.60- Slightly Influential, 1.00-1.80 – Not Influential

The grand mean of 4.42 expressed that all organizational factors are highly influential, having a variability of SD value of 0.60, which suggests that while all factors contribute significantly to organizational success, organizational culture and structure play an essential role. The findings are supported by Cruz (2015) and Cameron and Quinn (2011), who opined that organizational culture and structures collectively contribute to the efficiency and success of project implementation in the engineering field. It further resonates with the broader literature on organizational effectiveness, underscoring the need for continuous improvement and support at the organizational level to enhance the performance of field engineers.

3.2 Performance Level of DPWH Field Engineers

The second problem the study aims to answer is the performance level of the field engineers. The researchers obtained the data from the HR office of the DPWH Eastern Samar District Engineering Office through a letter sent by the researchers. The Performance evaluation was obtained during the study period. The mean performance level of DPWH field engineers is exceptionally high at 4.89, indicating that, on average, the engineers exhibit nearexcellent performance. This high performance level indicates effective management, robust training programs, and a supportive organizational culture that promotes continuous improvement and high standards. These findings are consistent with the broader literature on organizational effectiveness and performance management in engineering contexts (Cameron & Quinn, 2011; Cruz, 2018).

3.3 Relationship Between Factors

Table 5 shows the results of the hypotheses testing.

Table 5. Relationship between the individual factors, team, and organizational factors to field engineer's performance

	Individual Performance Commitment and Review (IPCR) Rating				
	r	p-value	Decision	Conclusion	Remarks
Individual Factors					
Technical Skills and Knowledge	0.306^{ns}	0.100	Retain Ho	Not Significant	Low Positive Correlation
Experience and Qualifications	0.162^{ns}	0.391	Retain Ho	Not Significant	Almost Negligible Correlation
Motivation and Attitude	0.332^{ns}	0.073	Retain Ho	Not Significant	Low Positive Correlation
Team Factors					
Communication & Collaborators	0.313^{ns}	0.092	Retain Ho	Not Significant	Low Positive Correlation
Leadership & Mgt. Skills	.407*	0.025	Reject Ho	Significant	Moderate Positive Correlation
Conflict Resolution & Cohesion	0.251^{ns}	0.181	Retain Ho	Not Significant	Low Positive Correlation
Organizational Factors					
Organizational Culture & Structure	0.356^{ns}	0.054	Retain Ho	Not Significant	Low Positive Correlation
Resource Allocation & Support	.427*	0.019	Reject Ho	Significant	Moderate Positive Correlation
Policies & Procedures	0.209^{ns}	0.269	Retain Ho	Not Significant	Low Positive Correlation

Legend: r - Pearson, ns - Not significant, * - Significant at 5% significance level (2-tailed).

The relationship between individual, team, and organizational factors and field engineers' performance measured by the Individual Performance Commitment and Review (IPCR) is shown in Table 5. As reflected, individual factors concerning technical skills and Knowledge (r = 0.306) and motivation and attitude (r = 0.332) show low positive correlations with field engineers' performance. They are not statistically significant, as their p-values exceed the statistical threshold 0.05. Experience and qualifications exhibit an almost negligible correlation (r = 0.162, p = 0.391), indicating little to no impact on the performance of field engineers.

For team factors, only leadership and management skills have a significant moderate positive correlation (r = 0.407, p = 0.025), which suggests that effective leadership substantially influences field engineers' performance. The null hypothesis is rejected for this factor, confirming its importance. However, communication and collaboration (r = 0.313) and conflict resolution and cohesion (r = 0.251) showed low correlations that are not statistically significant. On the organizational factors, the indicator resource allocation and support established a significant moderate positive correlation with the performance of field engineers (r = 0.427, p = 0.019), signifying that adequate resources and support have a meaningful impact on field engineers' performance.

Nevertheless, organizational culture and structure (r = 0.356) and Policies and procedures (r = 0.209) showed low correlations, with no significant relationship to performance. Thus, leadership and management skills, resource allocation, and support are the most influential factors affecting field engineers' performance, while other factors do not have significant impacts. This finding is supported by Cruz (2018), who stressed the importance of providing sufficient resources and support, such as training and mentorship, to enhance project implementation and the overall performance of engineers. Access to the necessary resources enables engineers to perform their tasks efficiently, directly contributing to improved performance outcomes. Similarly, Bell & Kozlowski (2008) underscored the need for a holistic approach to performance management that integrates individual competencies with organizational support and effective team dynamics to optimize overall performance outcomes.

4.0 Conclusion

The most critical individual factors that influence the performance of field engineers are motivation and attitude. Technical skills and experience/qualifications are also highly influential, emphasizing that while technical expertise is important, a positive mindset is crucial for optimal performance. Communication and collaboration for team factors are perceived to be essential for more variability. Organizational culture and structure are essential components of organizational factors, signifying that a well-defined culture is fundamental to organizational success. The performance of field engineers is exceptionally high, with minimal variability in performance levels. Statistically, a significant relationship was computed between leadership and management skills along with resource allocation and support to the performance of field engineers, suggesting that leadership and adequate resource provision are driving factors for the high performance of field engineers.

Thus, enhancing leadership development programs focused on decision-making, people management, and motivational leadership is recommended. Also, strengthening resource allocation and support ensures that field engineers have consistent access to tools, technologies, and support to perform their tasks effectively. The DPWH may continue to promote a work environment that supports collaboration and innovation for an engaging work environment. Likewise, they may structure policies regarding reward programs, career growth opportunities, and regular motivational workshops to maintain high morale and job satisfaction. Regular performance evaluation may continuously be done to ensure high-performance sustainability and identify improvement areas.

Further research on other individual factors, technological impacts, leadership styles, and the effect of remote work on engineers' productivity may be explored. Researchers may focus on conducting a deeper analysis of the different leadership styles employed by the DPWH heads to determine their specific effects on the performance of field engineers. Likewise, examine the influence of remote work on field engineers' productivity, collaboration, and work-life balance, considering the increase in hybrid work environments. Further exploration may also be conducted of individual factors of field engineers, such as emotional intelligence, stress management, or adaptability, which might also play a role in the performance of field engineers.

Moreover, based on the study's findings, the Supervisory Project Management Plan aims to improve the performance of DPWH field engineers by strengthening leadership, enhancing motivation, and optimizing allocation. Its scope includes addressing key individual team and organizational factors. It includes the following phases:

Phase 1. Leadership Development. This phase includes identifying leadership gaps. After that, leadership training programs focused on decision-making, communication, and team management are implemented.

Phase 2. Motivation and Attitude Enhancement. This will include designing reward and recognition programs for top-performing engineers and continuously conducting workshops on maintaining positive work attitudes and career growth.

Phase 3. Resource Allocation Optimization. This includes auditing DPWH's current allocation process to identify inefficiencies and providing field engineers timely access to necessary tools and support.

These plans will significantly enhance field engineers' performance through strategic leadership, motivation, and resource management improvements.

5.0 Contributions of Authors

Engr. Floria is the main author, from conceptualization of the paper, data gathering, and analysis of data; Engr. Ala- technical adviser and methodologist.

6.0 Funding

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7.0 Conflict of Interests

There is no conflict of interest recorded.

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