Title Name: Design Management Constraints and Perceived Organizational Performance of the Department of Public Works and Highways

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Abstract
This study investigated the impact of design management constraints on perceived organizational performance within the Department of Public Works and Highways (DPWH) in Region X, Philippines. Despite adherence to ISO standards and established procedures, the DPWH continues to face operational challenges, particularly in design management. Using a descriptive-causal research design, the study surveyed 104 participants from regional and district engineering offices to assess the extent of design management constraints, their relationship with perceived performance, and to develop a corresponding statistical model. Results revealed that the most prominent constraints were delays in receiving infrastructure project lists and difficulties in acquiring survey and geotechnical data. Perceived organizational performance was rated above average, with design management leadership emerging as the strongest dimension. Pearson correlation analysis indicated no significant relationship between overall design management constraints and perceived performance. However, multiple regression analysis identified constraints in the preparation of detailed engineering designs and detailed unit price analyses as significant predictors of perceived performance. These two factors collectively accounted for 14.4% of the variance in performance ratings. Although the regression model exhibited weak explanatory power, the findings suggest that specific technical and cost-related design challenges influence organizational effectiveness more than general constraints. This highlights the need for improved data acquisition, coordination, and technical capacity in these areas. Further research is recommended to explore additional factors—such as leadership practices, digital integration, and resource availability—that may better explain variations in organizational performance in public infrastructure agencies like the DPWH.

Keywords: design management, organizational performance, constraints, perception, management

1. Introduction

Every project, whether big or small, starts with proper planning. When plans and design documents are meticulously and intelligently crafted, projects can be executed in accordance with the required guidelines and standards of the organization. The Department of Public Works and Highways (DPWH) plays a crucial role in infrastructure development in the Philippines, necessitating effective design management practices for the successful planning and implementation of projects.

In the design management processes, DPWH has its Department Order No. 32, series of 2017, the Standard Procedures Manual, defining the procedures for the Regional Offices (ROs) and District Engineering

Offices (DEOs). Under the said Manual, the design management processes are defined under in the Conduct of Detailed Engineering Activities, which purposed to ensure all surveys and investigations, Detailed Engineering Design (DED) plans are prepared per standard specifications for highways, bridges, and flood control structures to come up with the most functional and cost-effective infrastructure design. This activity is a 25-step procedure that can be summarized into six (6) significant activities for this study, these are: Receipt of List of Infrastructure Projects, Acquisition of Survey and Subsurface Exploration Data, Preparation of Design Analyses, Preparation of DED Plans and Quantities, Preparation of Detailed Unit Price Analyses (DUPA) and Program of Works (POW) and Approval of DED Documents.

Recently, the Department, with the efforts of the Bureau of Design and the Information Management System, introduced a new policy through a new policy. This policy is designed to facilitate the systematic management of human resources, data, and resources during the preliminary and detailed engineering design phases of infrastructure projects. This Design Management Application ensures consistency in the design process and compliance with the Department's policies, guidelines, and specifications (Bonoan, 2023). It reinforces the previous policy while it enables a thorough oversight of projects.

Over several years, the regional and district implementing offices diligently adhered to the Standard Procedures Manual. However, persistent gaps and constraints continues to linger in the processes which profoundly impede their capacity to complete projects effectively and efficiently. These constraints manifest across the major activities and wield a significant influence over the performance of the organization.

Thus, the primary objective of this study was to examine the design management constraints in DPWH and their influence to the perceived organizational performance. Specifically, this study was aimed to address the following research questions: What is the level of hindrance experienced by DPWH in the Receipt of List of Infrastructure Projects? What is the level of hindrance experienced by DPWH in the Acquisition of Survey and Subsurface Exploration Data? What is the level of hindrance experienced by DPWH in the Preparation of Design Analyses? What is the level of hindrance experienced by DPWH in the Preparation of Detailed Engineering Design (DED) Plans and Quantities? What is the level of hindrance experienced by DPWH in the Preparation of Detailed Unit Price Analyses (DUPA) and Program of Works (POW)? What is the level of hindrance experienced by DPWH in the Approval of Detailed Engineering Design Documents? What is the level of Perceived Organizational Performance of DPWH particularly in the context of: Design Management Processes; Design Management Resources; and Design Management Leadership? Is there significant relationship between the Design Management Constraints and Perceived Organizational Performance? Which of the Design Management Constraints significantly influence the Perceived Organizational Performance? What statistical model best fits the Organizational Performance of DPWH?

This paper is structured into six sections to ensure a logical and comprehensive presentation of the research. Section 1 provides the introduction, outlining the background, objectives, and relevance of the study on design management constraints and organizational performance. Section 2 reviews related work, presenting existing literature and key concepts that support the study’s framework. Section 3 describes the research methodology, including the data collection methods, sampling approach, and statistical techniques employed. Section 4 presents the results, highlighting the key findings from descriptive statistics, correlation, and regression analyses. Section 5 offers a discussion of the results, interpreting their significance in light of previous studies and practical implications. Lastly, Section 6 concludes the paper by summarizing the main findings and proposing future research directions to enhance design management practices.

2. Related Literature

This study was grounded on several relevant theoretical concepts and models that provide the foundation for understanding the relationship between design management constraints and the perceived organizational performance. The following theoretical frameworks were applied to this research:

Systems Theory is a way of examining how things are organized, regardless of composition, nature, or temporal and spatial scale (Kauffman, 2019). At its core, systems theory emphasizes the concept of emergence, highlighting that the whole of a complex system exhibits qualities and behaviors that cannot be fully understood by simply analyzing its constituent parts (Barzel, 2016). In the realm of the DPWH, the systems theory approach is vital in providing the foundational framework for comprehending it as a sophisticated organizational system comprised of interlinked components that interact with other elements within itself and outside.

Resource-Based Theory provides a framework to highlight and predict the fundamentals of organizational performance and competitive advantage (Utami, 2023). It posits that the success of the company hinges on its unique bundle of resources - that are actively deployed to create and sustain a competitive edge through strategic development and continuous adaptation to market shifts (Teece, 2018). In the context of design management, this theory emphasizes the importance of identifying and effectively using the unique and diverse resources and capabilities of the organization to achieve sustained success in infrastructure projects. For DPWH, these resources may include specialized knowledge, skilled personnel, technology, and efficient processes specific to the infrastructure sector.

Kurt Lewin's Change Management Model acknowledges that change is more than just introducing new practices; it is about making these changes an integral part of the organization, its culture and operations. In the DPWH, unfreezing involves recognizing the need for change and acknowledging constraints within the existing design management practices. The Changing stage corresponds to the efforts to implement changes that address these constraints. And, refreezing happens when the organization stabilizes the latest practices and becomes the norm.

Design Management Constraints are invisible roadblocks that derail a successful project execution and can significantly hinder the effectiveness and efficiency of the design process, which leads to delays. These limitations, encompassing technical, logistical, and financial aspects which can significantly hinder project effectiveness and efficiency, potentially leading to delays, cost overruns, and compromised results (Dorner, 2014).

Technical constraints, as defined by Fernandes et al. (2023), are limitations inherent in the tools, technologies, and methodologies available to the design teams. These constraints can significantly hinder the ability of businesses to generate innovative design solutions and impede overall design effectiveness. While, *logistical constraints,* the unseen conductors of the design process, act as silent orchestrators dictating the pace and efficiency of project execution (Jensen, 2020). Whereas, *financial constraints* act as invisible boundaries, dictating the scope and feasibility of even the most brilliant ideas (Fernandes et al., 2023). Project budgets restrict critical resources like detailed analyses, innovative materials, and specialized tools, forcing design teams to walk a tightrope between cost-effectiveness and desired outcomes (Ojolowo, 2015). Ultimately, design management thrives not on boundless budgets but on the ability to navigate financial limitations with ingenuity and resourcefulness, ensuring success even when resources are scarce.

Listing of Infrastructure Projects. This vital document, the roadmap of DPWH to progress, faces a labyrinth of constraints that threaten to stall the development of the nation (COA, 2020). The General Appropriations Act (GAA) and National Expenditure Program (NEP), the financial lifelines for these projects, often arrive late, leaving the DPWH in the dark about project allocations (DBM, 2021). Inconsistent project guidelines add another layer of chaos. Different DPWH offices and agencies impose their own submission rules, creating a confusing maze for project proponents (DBM, 2019). The sheer volume of LIP submissions, especially during peak periods, overwhelms its staff (CSC, 2023). This bottleneck stretches project timelines, potentially grinding infrastructure development to a halt. Communication breakdowns exacerbate the problem. Information gaps between the DPWH, implementing agencies, and proponents lead to delays, misunderstandings, and missing documents (COA, 2019).

Data Acquisition. Technical limitations of equipment, environmental factors, and complex geological contexts can impede gathering reliable survey and subsurface exploration data (Ayanwola, 2013). Logistical hurdles like site access restrictions and bureaucratic processes can further complicate data collection (Olorunfemi, 2013). Financial constraints can limit the scope and quality of data acquisition efforts (Akinradewo, 2016).

Design and Analysis. Technical constraints like limited data and complex systems can compromise the accuracy and comprehensiveness of design analyses (Dorner, 2014). Logistical pressures like tight deadlines and competing priorities can lead to rushed analyses and overlooked critical considerations (Jones & Comfort, 2015). Financial constraints can restrict the allocation of resources for thorough analyses and modeling (Howard, 2014).

Detailed Engineering Design (DED). Insufficient or inaccurate data, complex system interactions, and restrictive assumptions can lead to flaws in DED plans and quantities (Walker, 2013). Logistical pressures can compromise the thoroughness and depth of DED preparation, while financial limitations can restrict the scope and detail of plans and quantities (American Society of Civil Engineers, 2013).

Detailed Unit Price Analyses (DUPA) and Program of Works (POW). Limited or inaccurate data, complex systems, and simplifying assumptions can lead to erroneous cost estimates and unrealistic construction schedules in DUPA and POW documents (DBM, 2022). Addressing these constraints requires comprehensive data collection, advanced modeling techniques, and consideration of alternative construction methods and materials (PMI-PH, 2021).

DED Approval. Limited data and complex systems can hinder the thoroughness of DPWH reviews, while logistical pressures can lead to rushed approvals and overlooked inconsistencies (DPWH, 2023).

Employee Perception and Organizational Performance Model posits that employee perceptions, encompassing their observations, experiences, and judgments regarding an organization, hold considerable sway over organizational performance (Murphy, 2018). This model highlights the intricate relationship between employee perceptions of organizational effectiveness and actual organizational performance outcomes (Aguinis & Oh, 2020). This model relates to Perceived Organizational Performance (POP) as a mosaic of impressions employees, customers, and stakeholders hold about the effectiveness and success of the organization, going beyond mere financial metrics (Kuipers & Diener, 2017). It is woven from internal threads like employee satisfaction and trust (Van den Berg et al., 2021), external strands like market reputation and customer loyalty (Anderson & Mittal, 2020), and individual

hues influenced by values and past experiences. Here are the its key indicators: design management processes, design management resources and design management leadership.
By integrating these theoretical frameworks, this study provides a comprehensive understanding of the interplay between design management constraints and perceived organizational performance within the DPWH, offering insights and recommendations for enhancing the overall effectiveness and efficiency of the organization. Figure 1 shows the interplay of the six (6) independent variables and the dependent variable of perceived organizational performance and its three components of design management processes, resources and leadership.

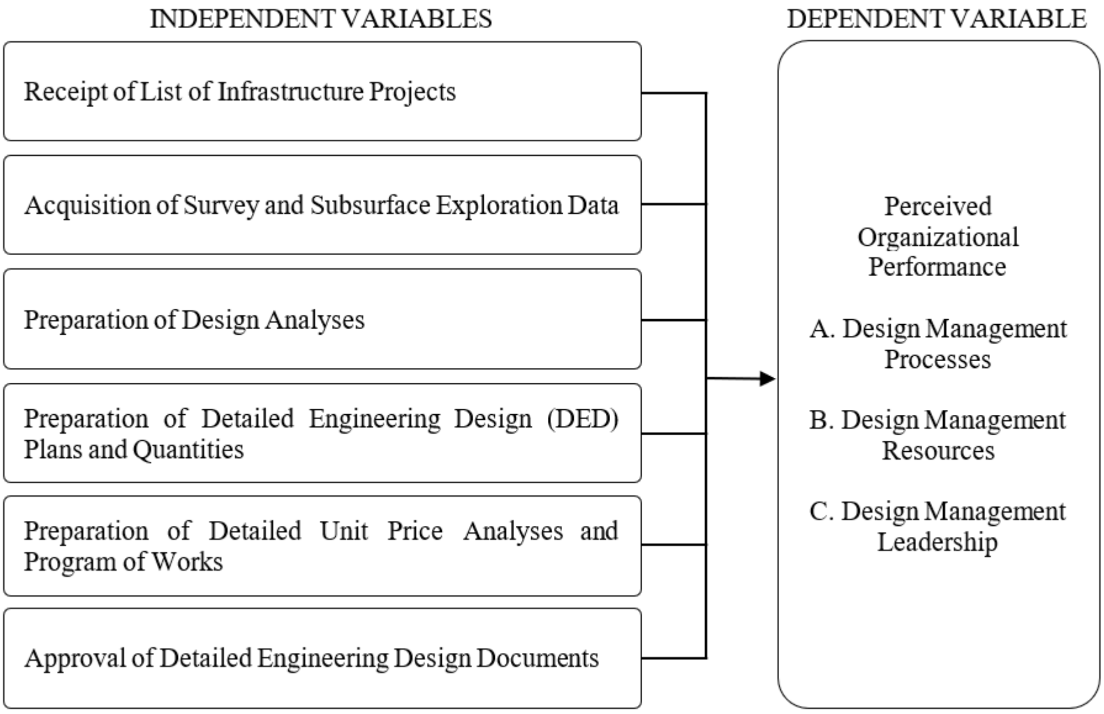


Figure 1. Schematic Diagram of the Variables of the Study

3. Methodology

This chapter outlined the methodological framework employed in the study, encompassing research design, data collection procedures, and data analysis techniques.

3.1 Research Design

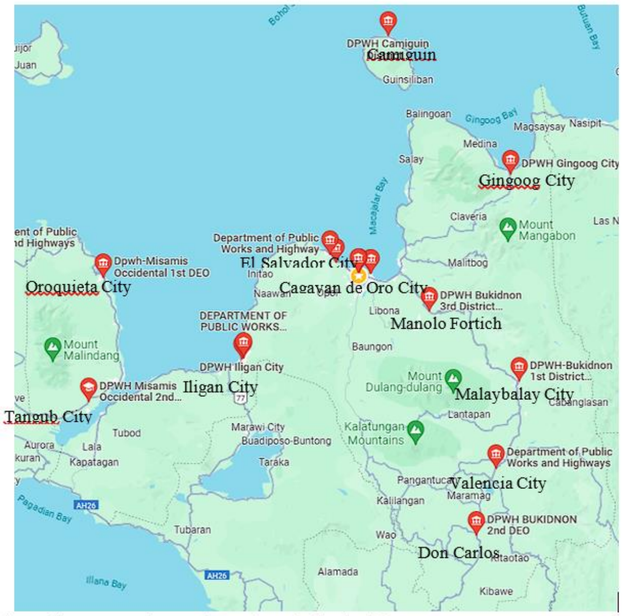
The researcher employed a descriptive-causal research design for this study. This design focused on describing the characteristics of each variable and at the same time seeks to establish the cause-and-effect relationships between design management constraints and perceived organizational performance.
Descriptive research aims to provide a detailed snapshot of the current situation, shedding light on the characteristics and factors at play within the chosen context. Descriptive statistics are techniques used to "summarize and describe the characteristics of a dataset" (Everitt & Hothorn, 2006). In this case, the researcher aimed to comprehensively describe the design management constraints present in DPWH and explore how these constraints may have been associated with the perceived performance of the organization.
Whereas, correlational research, involves examining the statistical relationships between variables without

intervening or manipulating them. The researcher employed this design to identify and measure the degree of association between design management constraints and the perceptions of organizational performance among employees.

While, causal research is an in-depth approach is crucial for understanding the "why" behind phenomena, allowing researchers to move beyond simply "what" or "how" something occurs (Trochim, 2006). Causal research, a type of quantitative investigation, specifically aims to identify causal relationships between variables. It seeks to determine whether changes in one variable (independent variable) cause changes in another variable (dependent variable).

3.2 Research Setting

In Region X, the responsibilities of DPWH extend to the design, construction, and maintenance of various national infrastructure projects, ensuring alignment with national development objectives. The Regional Office and the existence of the 14 District Engineering Offices (DEOs), comprising those in Bukidnon (1st DEO, 2nd DEO, 3rd DEO, and 4th Sub-DEO), Cagayan de Oro (1st DEO and 2nd DEO), Camiguin DEO, Iligan Lone DEO, Lanao (1st DEO and 2nd DEO), Misamis Occidental (1st DEO and 2nd DEO), and Misamis Oriental (1st DEO and 2nd DEO), set the localized focus of planning efforts of the Department. Figure 2 maps out the location of the various DPWH offices in Region X.



Source: https://www.google.com/maps/search/dpwh+/@8.4631751,124.1496757,9z?e ntry=ttu

Figure 2. Map showing the Location of DPWH Offices in Region X

3.3 Participants of the Study

The research focused on engineers involved in the design management processes. These included design section chiefs, assistant section chiefs, design unit heads, and design team leaders. The population of the study was 184 participants coming from the regional office and 14 district.

The sample size was determined using Cochran's Formula, which determines the appropriate size for a categorical data population in a survey or experiment. This statistical tool is used for evaluating the homogeneity of variances across multiple groups (Field & Gurevitch, 2022). The formula is expressed as for infinite populations, where n0 is the required sample size, p value of 80%, 95% confidence level (leading to an α = 0.05), and ±5% precision. From the z-tables, the value for z is 1.96. Therefore, the theoretical sample was:

$$n_0 = (1.96^2 \, x \, 0.8 \, x \, (1-0.8))/0.05^2 = 245$$

Applying the modified formula for finite population gives the final theoretical minimum number of samples of 104, as shown in the computation:

$$n = n_0 \, / \, (1 + (n_0 - 1)/N) = 245/(1 + (245-1)/184 = 104$$

Since the population is segmented, stratified sampling is the chosen method (Wahle et al., 2012). The stratified sampling of participants resulted in 17 participants from the Regional Office and 7 from each DEO, for a total sample size of 115 participants. However, Table 1 presents the actual number of participants in the study with adjustments made to achieved the response rate of 90.43% with 104 samples.

Office	Population	Sample	Percentage %
Regional Office	30	20	19.2
Bukidnon 1st DEO	11	7	6.7
Bukidnon 2nd DEO	11	7	6.7
Bukidnon 3rd DEO	11	7	6.7
Bukidnon 4th Sub-DEO	11	1	1.0
Cagayan de Oro 1st DEO	11	7	6.7
Cagayan de Oro 2nd DEO	11	4	3.8
Camiguin DEO	11	5	4.8
Iligan Lone DEO	11	6	5.8
Lanao del Norte 1st DEO	11	7	6.7
Lanao del Norte 2nd DEO	11	7	6.7
Misamis Occidental 1st DEO	11	6	5.8
Misamis Occidental 2nd DEO	11	7	6.7
Misamis Oriental 1st DEO	11	6	5.8
Misamis Oriental 2nd DEO	11	7	6.7
Total	**N = 184**	**n = 104**	**100**

Table 1. Participants of the Study

3.4 Research Instruments

Data was collected using self-made descriptive survey questionnaires designed to be completed within 20-30 minutes. These questionnaires were distributed in both paper and online formats. This mixed-mode approach offered the advantages of broader reach and flexibility of online surveys while maintaining the accessibility and personal touch of paper surveys (Fan & Sæther, 2016).

The first part of the survey gathered the basic information of the participants, including their name (optional), designation and office. The main content of the survey was divided into two parts. Part 1 focused on design management constraints with a series of statements related to different categories (technical, logistical, and financial) to gauge their level of agreement. Then, part 2 explored participants' perception of organizational performance. Another set of statements measured their level of agreement with the three attributing elements of design management: processes, resources, and leadership.

3.5 Scoring Procedure

Every item in the questionnaire was assessed using a 5-point Likert scale, wit: "Strongly Agree," "Agree," "Neutral," "Disagree," and "Strongly Disagree" (Brownlee, 2023). Each response option corresponded to a numerical score, ranging from 1 for "Strongly Disagree" to 5 for "Strongly Agree." Higher scores indicated stronger agreement with the statement, and lower scores reflected stronger disagreement (Van de Voordt et al., 2018).

Average response scores for both variables were evaluated using numerical range: "Strongly Agree" (4.21 - 5.00) interpreted as “High,” "Agree" (3.41 - 4.20) as “Above Average,” "Neutral" (2.61 - 3.40) as “Average,” "Disagree" (1.81 - 2.60) as “Below Average,” and "Strongly Disagree" (1.00 - 1.80) as “Low.”

3.6 Data Gathering and Procedure

In adherence to the University protocols, the survey was administered personally. Permissions were sought both from the school and the study sites—RO and 14 DEOs. Copies of consent letters, informed consent forms and research instruments were provided to the research participants, verifying their voluntary involvement for the study and willingness to complete the survey questionnaires.

Participants in the survey included the design section chiefs, assistant chiefs, unit heads, and team leaders only. In case of withdrawal or termination, participants could do so and at any time. Participants were also explained about the risks and benefits, reimbursement and compensation (if applicable), confidentiality, and study results sharing.

Regarding the confidentiality of the collected data, the researcher complied with the Data Privacy Act of 2012 and data be kept confidential and anonymous. The data was used solely for research purposes and participant identities were handled discreetly. Raw data were consolidated and stored securely within the researcher’s facility and after six months of storage, it will be destroyed. The findings and results of the study will be broadly shared through publications and conferences.

Variables	Initial Number of Statement	Deleted Statements	Final Number of Statements
1. Constraints in the Receipt of List of Infrastructure Projects	15	3	12
2. Constraints in the Acquisition of Survey and Subsurface Exploration Data	15	3	12
3. Constraints in the Preparation of Design Analyses	15	6	9
4. Constraints in the Preparation of Detailed Engineering Design (DED) Plans and Quantities	15	0	15
5. Constraints in the Preparation of Detailed Unit Price Analysis (DUPA) and Program of Works (POW)	15	3	12
6. Constraints in the Approval of Detailed Engineering Design (DED) Documents	15	3	12
7. Perceived Organizational Performance - A. Design Management Processes	10	1	9

8. Perceived Organizational Performance - B. Design Management Resources	10	1	9
9. Perceived Organizational Performance - C. Design Management Leadership	10	1	9

Table 2. Number of Survey Questionnaire Statements

3.7 Validity and Reliability of Research Instruments

To gauge the validity and reliability of the research instrument, a pilot test was conducted on a subset of 30 responses, excluding them from the main study (Sheehan & Steel, 2021). While the ideal sample size for pilot testing depended on the chosen tests and the precision desired (Cao & Thompson, 2023), general guidelines suggested 30-50 responses as sufficient for most reliability and validity assessments (DeVellis, 2023).

Data were analyzed using IBM SPSS Statistics employing the Cronbach alpha coefficient. Internal consistency was assessed by examining individual item reliabilities (Cortina, 2019). Only reliable items within the 0.70-0.95 range (Tavakol & Dennick, 2011) contributed to the final instrument, ensuring high validity and precision. Weakly correlated items (< 0.30 item-total correlation) were removed. The following are the results of the analysis: IV1= 0.845, IV2 = 0.888, IV3 = 0.741, IV4 = 0.880, IV5 = 0.881, IV6 = 0.872, DV1 = 0.922, DV2 = 0.913, DV3 = 0.834.

Table 2 presents the final number of items in the questionnaire.

3.8 Statistical Techniques

Descriptive statistics was used, specifically the means for each variable (Field, 2022), to identify and determine the level of constraints in the independent variables and the level of perceived organizational performance of DPWH. In order to understand the interplay between design management constraints and perceived organizational performance, the Pearson's product-moment correlation (Laerd Statistics, 2022) was utilized. This sheds light on the potential relationships between these variables. Then, to delved deeper into quantifying the influence of design management constraints on perceived organizational performance, multiple linear regression (Hair et al., 2022) was applied. This technique allowed the researchers to estimate the individual and combined effects of each constraint on the overall performance score.

Lastly, a statistical model can be constructed which describes the relationship between multiple independent variables (predictors) and the dependent variable (outcome). The model is represented as an equation, commonly known as the regression equation. As noted by Menard (2020), the general form of a multiple regression equation with p predictors can be expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + \varepsilon$$

Y represents the dependent variable, while X_1, X_2, …, X_p denote the independent variables, β_0 represent the intercept, and β_1, β_2, …, β_p signify the coefficients representing the change in Y. Once the multiple regression model has been fitted to the data, predictions about the dependent variable can be made based on specific values of the independent variables.

4. Results

This section presents the main findings of the study, including the levels of design management constraints and perceived organizational performance. It also shows the results of the correlation and regression analyses, highlighting which constraints are significantly related to or predictive of organizational performance.

4.1 Level of Design Management Constraints

Table 3 presents a summary of the results for the six (6) design management constraints. A high level of constraint was observed in the receipt of the list of infrastructure projects, with a mean of 4.23 and a standard deviation (SD) of 0.49. This was largely attributed to the inclusion of unvalidated projects that were later deemed unimplementable, delays in receiving project lists from other agencies, the late finalization of national budgets (e.g., the National Expenditure Program, General Appropriations Act), and the lack of transportation vehicles for project validation.

Independent Variables	Total Mean	SD	Description	Interpretation
1. Constraints in the Receipt of List of Infrastructure Projects	4.23	0.49	Strongly Agree	High
2. Constraints in the Acquisition of Survey and Subsurface Exploration Data	4.34	0.48	Strongly Agree	High
3. Constraints in the Preparation of Design Analyses	4.05	0.61	Agree	Above Average
4. Constraints in the Preparation of Detailed Engineering Design (DED) Plans and Quantities	3.92	0.57	Agree	Above Average
5. Constraints in the Preparation of Detailed Unit Price Analysis (DUPA) and Program of Works (POW)	3.85	0.62	Agree	Above Average
6. Constraints in the Approval of Detailed Engineering Design (DED) Documents	3.84	0.57	Agree	Above Average
Grand Mean	**4.04**	**-**	**Agree**	**Above Average**

Legend:

5	4.21 - 5.00	-	Strongly Agree	High
4	3.41 - 4.20	-	Agree	Above Average
3	2.61 - 3.40	-	Neutral	Average
2	1.81 - 2.60	-	Disagree	Below Average
1	1.00 - 1.80	-	Strongly Disagree	Low

Table 3. Summary of Design Management Constraints, n = 104

Similarly, a high level of constraint was identified in the acquisition of survey and subsurface exploration data, with a mean of 4.34 and SD of 0.48. The results indicate that significant delays occur in the procurement and conduct of these activities, which in turn hinder the timely commencement of detailed engineering design. Contributing factors include limited access to survey sites, poor coordination and collaboration among stakeholders, and the lack of appropriate equipment.

An above-average level of constraint was also noted in the preparation of design analyses, with a mean of 4.05 and SD of 0.61. The most significant challenge in this area was the lack or unavailability of design data, tools, and equipment. Additionally, insufficient time for data validation, which affects the accuracy of design analyses, contributed to the constraints. Interestingly, lower mean scores were associated with the lack of training and budget for job order personnel.

The preparation of detailed engineering design (DED) plans and quantities also exhibited an above-average level of constraint, with a mean of 3.92 and SD of 0.57. Key contributing factors included frequent design revisions, delays in the release of project lists and design data, and the complexity of design requirements. Budgetary issues, such as limited funds for plotting machines and office supplies, were found to have less impact.

Similarly, an above-average constraint level was observed in the preparation of detailed unit price analysis (DUPA) and program of works (POW), with a mean of 3.85 and SD of 0.62. The primary issue was the lack of standard DUPA for new items. Additional challenges included frequent changes in unit costs, delays in the issuance of Construction Material Price Data (CMPD) from the Central Office, and insufficient coordination among stakeholders and design teams in finalizing project quantities. Budget limitations related to office supplies, printing machines, and software were found to have minimal impact.

Finally, the approval of DED documents registered the lowest mean among the six constraints, at 3.84 with SD of 0.57, yet still indicated an above-average level. The most critical issue was the volume of projects contributing to approval delays. Other notable factors included the unavailability of authorized signatories and the lack of effective communication, coordination, and follow-up among offices within the organization. Budget-related constraints had the least impact in this area.

4.2 Level of Perceived Organizational Performance

Table 4 presents the descriptive statistics of the perceived organizational performance and its three (3) key attributes.

The first attribute, design management processes, demonstrated an above-average performance level, with an overall mean of 3.68 and a standard deviation (SD) of 0.73. The highest contributing factor was the organization's clear definition of its design processes. Other significant contributors included the organization's ability to effectively monitor and control the timeline of design management activities, as well as its adherence to the established design management flowchart.

The second attribute, design management performance, also received an above-average rating, with a mean of 3.60 and an SD of 0.65—the lowest among the three attributes. The highest-rated factor was employee satisfaction with their skills and knowledge within the design management teams. Other closely related contributing factors included the organization's effective use of tools and platforms to support design activities, the provision of adequate supplies and equipment, and the clear definition of lines of responsibility and authority. Lower scores were associated with the organization's limited manpower to efficiently implement design management activities.

Lastly, the attribute design management leadership received the highest overall rating, with a mean of 3.72 and an SD of 0.62. High scores were associated with the organization's ability to make informed decisions based on design expertise and professional recommendations. Conversely, the lowest-rated factor pertained to the organization's leadership in recognizing and rewarding successful design management outcomes.

Perceived Organizational Performance Components	Total Mean	SD	Description	Interpretation
1. Design Management Processes	3.68	0.73	Agree	Above Average

2. Design Management Resources	3.60	0.65	Agree	Above Average
3. Design Management Leadership	3.72	0.68	Agree	Above Average
Grand Mean	**3.67**	**0.62**	**Agree**	**Above Average**

Legend:

5	4.21 - 5.00	-	Strongly Agree	High
4	3.41 - 4.20	-	Agree	Above Average
3	2.61 - 3.40	-	Neutral	Average
2	1.81 - 2.60	-	Disagree	Below Average
1	1.00 - 1.80	-	Strongly Disagree	Low

Table 4. Summary of Perceived Organizational Performance, n = 104

4.3 Relationship of Design Management Constraints and Perceived Organizational Performance

Table 5 presents the results of the correlation analysis examining the relationship between various design management constraints and perceived organizational performance. The findings revealed that most of the identified constraints did not exhibit statistically significant correlations with organizational performance. Specifically, constraints related to the receipt of project lists (r = -0.089, p = 0.370), acquisition of survey and subsurface exploration data (r = -0.081, p = 0.411), preparation of detailed engineering designs and quantities (r = -0.134, p = 0.176), preparation of detailed unit price analyses and program of works (r = 0.061, p = 0.536), and approval of DED documents (r = 0.039, p = 0.692) all demonstrated statistically non-significant correlations with perceived organizational performance.

However, an exception was observed in the constraint related to the preparation of design analyses, which showed a weak but statistically significant negative correlation with perceived performance (r = -0.206, p = 0.036). Despite the low correlation coefficient, the statistical significance suggests a noteworthy association between difficulties in conducting design analyses and reduced organizational performance.

Variable	**r**	**p-value**	**Interpretation**
1. Constraints in the Receipt of List of Infrastructure Projects	-0.089	0.370	Not significant
2. Constraints in the Acquisition of Survey and Sub-exploration Data	-0.081	0.411	Not significant
3. Constraints in the Preparation of Design Analyses	-0.206*	0.036	**Significant**
4. Constraints in the Preparation of Detailed Engineering Design (DED) Plans and Quantities	-0.0134	0.176	Not significant
5. Constraints in the Preparation of Detailed Unit Price Analysis (DUPA) and Program of Works (POW)	0.061	0.536	Not significant
6. Constraints in the Approval of Detailed Engineering Design (DED) Documents	0.039	0.692	Not significant

Table 5. Pearson's Correlation Analysis

4.4 Influence of Design Management Constraints to Perceived Organizational Performance

Table 6 shows the results of the regression analysis examining the relationship between design management constraints and perceived organizational performance. The model has an R-squared value of 0.144, indicating that 14.4% of the variation in performance can be explained by the identified constraints. The overall model is statistically significant, with an F-statistic of 2.714 and a p-value of 0.018, suggesting that the constraints, taken together, influence performance. Among the six predictors, two constraints were found to be statistically significant: constraints in the preparation of detailed engineering design (DED) plans and quantities (p = 0.026), and constraints in the preparation of detailed unit price analyses (DUPA) and program of works (POW) (p = 0.024). These results highlight that issues in preparing design plans and cost-related documents have a notable impact on perceived organizational performance.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.885	0.596		6.521	0.000
1. Constraints in the Receipt of List of Infrastructure Projects	0.014	0.184	0.011	0.075	0.940
2. Constraints in the Acquisition of Survey and Sub-exploration Data	0.041	0.178	0.031	0.231	0.818
3. Constraints in the Preparation of Design Analyses	-0.260	0.176	-0.256	-1.475	0.143
4. Constraints in the Preparation of Detailed Engineering Design (DED) Plans and Quantities	-0.500	0.221	-0.461	-2.266	*0.026
5. Constraints in the Preparation of Detailed Unit Price Analysis (DUPA) and Program of Works (POW)	0.373	0.162	0.369	2.295	*0.024
6. Constraints in the Approval of Detailed Engineering Design (DED) Documents	0.291	0.163	0.265	1.786	0.077

Table 6. Regression Analysis of Predictor Variables and Perceived Organizational Performance

4.5 Statistical Model of Perceived Organizational Performance of DPWH

Based on the standardized beta coefficients obtained from Table 6 ($\beta_0 = 3.885$, $\beta_1 = 0.011$, $\beta_2 = 0.031$, $\beta_3 = -0.256$, $\beta_4 = -0.461$, $\beta_5 = 0.369$, $\beta_6 = 0.265$), the regression model equation for this analysis can be expressed as:

$$Y = 3.885 + 0.011X_1 + 0.031X_2 - 0.256X_3 - 0.461X_4 + 0.369X_5 + 0.265X_6$$

This model incorporates all six predictor variables, including those that were not found to be statistically significant. While some coefficients are relatively small or associated with non-significant predictors, their inclusion provides a comprehensive view of the potential effects of each design management constraint on perceived organizational performance.

5. Discussion

This section discusses the key findings of the study and their implications. It explains how the identified design management constraints affect perceived organizational performance and compares the results with previous research.

The findings of this study provide valuable insights into the role of design management constraints in influencing perceived organizational performance. The results show that several constraints within the design management process are rated at above-average to high levels, suggesting widespread challenges in managing infrastructure project designs. Notably, high levels of constraint were observed in the acquisition of survey and subsurface data and the receipt of infrastructure project lists. These findings underscore the impact of inefficient data collection and validation processes on project execution timelines. Such issues are consistent with earlier studies highlighting those delays in project initiation stages—especially in data gathering and validation—can significantly compromise project planning and design accuracy (Doloi, 2013; Love et al., 2015).

The preparation of design analyses also showed a relatively high level of constraint and was the only variable found to have a statistically significant negative correlation with perceived organizational performance. This suggests that limitations in accessing reliable design data, tools, and adequate time for validation may reduce design quality and negatively affect overall organizational outcomes. Previous research supports this interpretation, noting that inadequate technical resources and poorly managed design processes often result in inefficiencies and rework, which can hinder performance (Jarkas & Haupt, 2015; Toor & Ogunlana, 2010). Although factors such as training and budget for job order personnel were rated lower, their indirect impact—especially in terms of workforce capability and skill development—should not be underestimated (Ofori, 2015).

Regression analysis further revealed that, while the overall model was statistically significant, only two constraints emerged as significant predictors of perceived performance: constraints in the preparation of detailed engineering design (DED) plans and quantities, and constraints in the preparation of detailed unit price analyses (DUPA) and program of works (POW). These results suggest that inefficiencies in these technical and cost-related processes play a key role in shaping organizational performance. Accurate DED and cost estimates are critical for budgeting, scheduling, and resource allocation, and deficiencies in these areas can cascade into broader project failures (Alzahrani & Emsley, 2013; Zhang et al., 2016).

Interestingly, other constraints—such as delays in project approvals, receipt of project lists, and acquisition of field data—did not show statistically significant relationships with performance, even though they were rated as highly constraining. This may indicate that while these challenges are prevalent, their impact on performance may be mitigated by other factors such as organizational adaptability, informal communication networks, or the resilience of project teams.

The standardized regression model offers further insight into the relative influence of each variable. Although some predictors showed small coefficients and lacked statistical significance, their inclusion contributes to a holistic understanding of how various design management activities interact to influence organizational performance. This aligns with systems thinking in project management, which emphasizes that even minor inefficiencies in interconnected processes can have cumulative effects on performance outcomes (Sterman, 2000).

In summary, the study confirms that while several design management constraints exist across the project lifecycle, targeted improvements in the preparation of design plans and cost documentation may offer the most direct and measurable benefits to organizational performance. Future efforts should focus on strengthening technical capabilities, improving inter-agency coordination, and leveraging digital tools to streamline data handling and design workflows.

6. Conclusion

This study explored the impact of design management constraints on perceived organizational performance within the Department of Public Works and Highways (DPWH) in Region X. The investigation covered six key constraints: receipt of infrastructure project lists, acquisition of survey and subsurface data, preparation of design analyses, preparation of detailed engineering design (DED) plans and quantities, preparation of detailed unit price analysis (DUPA) and program of works (POW), and approval of DED documents. Results revealed that all six constraints were present at above-average to high levels, indicating persistent operational and procedural challenges in the design management process. Among the constraints, the acquisition of survey data and receipt of project lists were found to be the most pressing, primarily due to delays, lack of validation, and logistical issues. Despite this, the correlation analysis showed that most constraints did not have a statistically significant relationship with perceived organizational performance, suggesting that while these constraints exist, they may be mitigated by adaptive organizational practices or may not directly influence performance as perceived by employees.

However, the preparation of design analyses stood out with a statistically significant negative correlation with perceived performance. This indicates that inaccuracies or inefficiencies in this area can directly impair organizational output. Furthermore, regression analysis identified two constraints—preparation of DED plans and quantities, and preparation of DUPA and POW—as significant predictors of performance. This suggests that the technical precision and cost-related planning involved in these processes are critical to the organization's perceived effectiveness.

The findings emphasize the need for targeted interventions in improving data quality, design accuracy, and cost estimation methods. Enhancing inter-agency coordination, digitalizing processes, and strengthening design team capabilities could help address these constraints. Although the regression model explains only a portion (14.4%) of performance variability, it highlights key areas for strategic improvements.

Future research should consider exploring additional variables such as leadership effectiveness, project funding cycles, organizational culture, and the integration of digital technologies to further understand and enhance organizational performance in public infrastructure planning and execution.

References

1. Aguinis, H., & Oh, I. S. (2020). Best-practice recommendations for designing, implementing, and evaluating induction programs. *Human Resource Management*, *59*(1), 51–66. https://doi.org/10.1002/hrm.21950
2. Akinradewo, O. D. (2016). An evaluation of site investigation practices for foundation design in Nigeria. *Journal of Construction in Developing Countries*, *21*(2), 27–42.
3. Alzahrani, J. I., & Emsley, M. W. (2013). The impact of contractors' attributes on construction project success: A post construction evaluation. *International Journal of Project Management*, *31*(2), 313–322. https://doi.org/10.1016/j.ijproman.2012.06.006
4. American Society of Civil Engineers. (2013). *Failure to act: The impact of current infrastructure investment on America's economic future*. ASCE.
5. Anderson, E. W., & Mittal, V. (2020). Strengthening the satisfaction-profit chain. *Journal of Service Research*, *3*(2), 107–120.

6. Ayanwola, A. (2013). Engineering geophysics in road construction and foundation evaluation. *International Journal of Applied Science and Technology*, *3*(5), 68–75.
7. Barzel, B. (2016). Emergence in complex systems. In C. Gershenson (Ed.), *Complexity: 5 Questions* (pp. 15–20). Automatic Press.
8. Brownlee, J. (2023). *Probability for machine learning: Discover how to harness uncertainty with Python*. Machine Learning Mastery.
9. Cao, J., & Thompson, B. (2023). Best practices in pilot testing: Sample size and reliability. *Educational Measurement: Issues and Practice*, *42*(1), 15–22.
10. Commission on Audit. (2019). *Annual audit report: Department of Public Works and Highways*. COA.
11. Commission on Audit. (2020). *Audit observations on delays in infrastructure projects*. COA.
12. Cortina, J. M. (2019). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, *78*(1), 98–104.
13. CSC (Civil Service Commission). (2023). *Workload and staffing guidelines for government agencies*. CSC Memorandum Circulars.
14. DBM (Department of Budget and Management). (2019). *Budget operations manual for local government units*. DBM.
15. DBM. (2021). *General Appropriations Act FY 2021*. https://www.dbm.gov.ph
16. DBM. (2022). *Guidelines on unit price analysis and cost estimation*. DBM Circular No. 2022-08.
17. DeVellis, R. F. (2023). *Scale development: Theory and applications* (5th ed.). SAGE Publications.
18. Doloi, H. (2013). Cost overruns and failure in project management: Understanding the roles of key stakeholders in construction projects. *Journal of Construction Engineering and Management*, *139*(3), 267–279. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000621
19. DPWH (Department of Public Works and Highways). (2023). *Design Management Guidelines and Applications Manual*. DPWH Bureau of Design.
20. Everitt, B. S., & Hothorn, T. (2006). *A handbook of statistical analyses using R*. Chapman and Hall/CRC.
21. Fan, W., & Sæther, T. (2016). Comparing paper and online survey responses: Differences in data quality. *Social Science Computer Review*, *34*(3), 298–310.
22. Fernandes, L., Carvalho, M. M., & Pinto, A. (2023). Managing design constraints in engineering projects: A framework for constraint classification. *Engineering Management Journal*, *35*(1), 25–39.
23. Field, A. (2022). *Discovering statistics using IBM SPSS statistics* (6th ed.). SAGE Publications.
24. Field, A., & Gurevitch, J. (2022). *Design and analysis in ecological research* (3rd ed.). Oxford University Press.
25. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2022). *Multivariate data analysis* (8th ed.). Cengage.
26. Howard, S. (2014). Budget constraints in public infrastructure: Impact on quality and innovation. *Journal of Infrastructure Systems*, *20*(4), 04014028.
27. Jarkas, A. M., & Haupt, T. C. (2015). Major construction risk factors considered by general contractors in Qatar. *Journal of Engineering, Design and Technology*, *13*(1), 165–194. https://doi.org/10.1108/JEDT-03-2014-0012
28. Jensen, D. (2020). Logistical limitations in urban design and construction. *International Journal of Logistics Management*, *31*(2), 178–190.

29. Jones, P., & Comfort, D. (2015). A commentary on the development of engineering design management in public infrastructure. *International Journal of Engineering Business Management*, *7*, 1–8.
30. Kuipers, L., & Diener, E. (2017). The subjective dimension of organizational performance. *Organizational Psychology Review*, *7*(4), 271–290.
31. Laerd Statistics. (2022). *Pearson product-moment correlation*. https://statistics.laerd.com
32. Love, P. E. D., Simpson, I., Hill, A., & Standing, C. (2015). From justification to evaluation: Building Information Modeling for asset owners. *Automation in Construction*, *55*, 1–10. https://doi.org/10.1016/j.autcon.2015.03.003
33. Menard, S. (2020). *Applied logistic regression analysis* (3rd ed.). SAGE Publications.
34. Murphy, K. R. (2018). Understanding performance ratings: Issues, insights, and research agendas. *Industrial and Organizational Psychology*, *11*(3), 376–389.
35. Ojolowo, S. (2015). Financial constraints and project delays in Nigeria's public infrastructure sector. *Journal of African Infrastructure Development*, *3*(2), 49–60.
36. Ofori, G. (2015). Nature of the construction industry, its needs and its development: A review of four decades of research. *Journal of Construction in Developing Countries*, *20*(2), 115–135. https://doi.org/10.21315/jcdc2015.20.2.7
37. Olorunfemi, M. O. (2013). Challenges in geophysical data acquisition in tropical environments. *Nigerian Journal of Science*, *47*(1), 63–71.
38. PMI-PH (Project Management Institute - Philippines Chapter). (2021). *Standards for cost estimation and project planning in public works*. PMI-PH Guidelines.
39. Sheehan, K. B., & Steel, R. (2021). Survey pre-testing and pilot testing: Practical considerations. *International Journal of Market Research*, *63*(1), 1–14.
40. Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. McGraw-Hill.
41. Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd
42. Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, *51*(1), 40–49. https://doi.org/10.1016/j.lrp.2017.06.007
43. Toor, S. R., & Ogunlana, S. O. (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International Journal of Project Management*, *28*(3), 228–236. https://doi.org/10.1016/j.ijproman.2009.05.005
44. Utami, T. (2023). Resource-based theory: Building blocks of competitive advantage. *Strategic Management Journal of Indonesia*, *5*(1), 13–27.
45. Van de Voordt, D. J. M., Jensen, P. A., & Coenen, C. (2018). *Workplace design and productivity: New approaches*. Routledge.
46. Van den Berg, P. T., Veldhoven, M., & Paauwe, J. (2021). Understanding employee perceptions of performance: A multidimensional model. *Human Resource Management Review*, *31*(3), 100743.
47. Wahle, R. A., May, K., & Belcher, J. (2012). Stratified sampling in multi-stage research: Application and strategy. *Journal of Applied Research Methods*, *22*(2), 32–44.
48. Zhang, S., Teizer, J., Lee, J. K., Eastman, C. M., & Venugopal, M. (2013). Building Information Modeling (BIM) and safety: Automatic safety checking of construction models and schedules. *Automation in Construction*, *29*, 183–195. https://doi.org/10.1016/j.autcon.2012.05.006