Overrun Analysis of Academic Building Projects in the Greater Manila Area Using Analytic Hierarchy Process

Miguel Nino S. Muli
Department of Civil Engineering, De La Salle University

Alpha G. Mabunga
Department of Civil Engineering, De La Salle University

Maria Emilia P. Sevilla
Department of Civil Engineering, De La Salle University

https://doi.org/10.5109/7395721

出版情報：Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 11, pp.1605-1612, 2025-10-30. International Exchange and Innovation Conference on Engineering & Sciences
バージョン：

Overrun Analysis of Academic Building Projects in the Greater Manila Area Using Analytic Hierarchy Process

Miguel Nino S. Muli[1], Alpha G. Mabunga[1], Maria Emilia P. Sevilla[1,2]
[1]Department of Civil Engineering, De La Salle University, [2]Department of Innovation and Sustainability, De La Salle University, Philippines
Corresponding Author: alpha.mabunga@dlsu.edu.ph

Abstract: *The implementation of the K-to-12 curriculum in the Philippines led to a surge in academic building construction. However, many of these projects experience cost and time overruns, particularly in the Greater Manila Area, where infrastructure development has struggled to keep pace with growing student populations. This study utilizes the Analytic Hierarchy Process (AHP) to identify and prioritize the key factors contributing to these overruns. Industry experts in construction and project management participated in the analysis. Results revealed that Project Planning and Scope Definition (PPSD) is the most critical factor, followed by Scope Changes and Requirements (SCR), and Communication and Coordination (CC). The findings emphasize the need for effective planning, scope management, and coordination to reduce delays and budget deviations. Recommendations are proposed to help stakeholders enhance construction efficiency and develop best practices for future academic projects.*

Keywords: Time Overrun; Cost Overrun; Academic Buildings; Analytic Hierarchy Process; Project Planning.

1. INTRODUCTION

1.1 Background of the Study

The Philippine educational system underwent a major transformation with the implementation of the K to 12 curriculum in June 2012, which extended the pre-university education cycle from ten to twelve years [1]. This academic reform brought a significant increase in student enrollment and created a pressing demand for additional academic infrastructure, particularly in densely populated regions such as the Greater Manila Area (GMA). In response, both government and private sectors initiated widespread construction of academic buildings to accommodate the surge in learners and support the revised educational framework.

Despite this rapid development, many academic building projects in the Greater Manila Area face persistent challenges in terms of cost and time overruns. Cost overruns occur when the actual expenditure exceeds the allocated budget, while time overruns refer to project delays beyond the scheduled completion [2]. These issues often result in resource inefficiencies, disrupted academic operations, compromised educational environments, and increased financial burdens for stakeholders [3],[4]. Given Manila's complex urban landscape and high population density, these challenges are further compounded by logistical constraints, bureaucratic delays, market volatility, and infrastructure limitations [5],[6]. A study in Japan [7] concluded that to be able ensure a thriving campus-city dynamic, decision-makers should thoroughly evaluate location suitability while considering the resulting social and economic impacts.

Various studies have explored various causes of construction project overruns globally and locally, frequently cited are inadequate planning, ineffective project management, scope modifications, and external market conditions as significant contributors. However, there remains a notable research gap concerning academic building projects specifically within the context of the Greater Manila Area using the Analytic Hierarchy Process (AHP). Academic institutions have unique functional and regulatory demands, making it essential to understand how overrun factors apply distinctly to this sector.

This study addresses the gap by applying the Analytic Hierarchy Process (AHP), a structured multi-criteria decision-making method, to systematically identify and prioritize the key factors contributing to cost and time overruns in academic construction projects [8]. AHP allows for the expert evaluation of qualitative and quantitative factors through expert judgment, providing a clear ranking of their relative importance.

The main objective of this research is to support decision-makers including contractors, educational institutions, and government agencies in developing targeted strategies to mitigate overruns and improve overall project outcomes. Lastly, the study aims to contribute to more efficient construction planning, reduce risk of budget and time deviations and increase likelihood of successful project completion.

Furthermore, regulatory bodies and respective authorities can utilize the findings to develop standards and best practices that address the identified factors contributing to overruns. This can result in more effective regulations and guidelines that promote cost-effective construction practices and improve project outcomes. By mitigating overruns and improving project efficiency, the construction industry in the Greater Manila Area can enhance its competitiveness. Academic building projects that go well can help the economy grow and add to the general growth of the area's educational infrastructure.

1.2 Scope, Limitations, and Delimitations

This study focuses on analyzing cost and time overruns specifically in academic building projects within the Greater Manila Area (GMA) using the Analytic Hierarchy Process (AHP). The analysis begins from the year 2012, marking the implementation of the K-12 educational reform in the Philippines. The scope of the study is limited to college building projects in private universities within the GMA, which includes Metro Manila and the surrounding provinces of Rizal, Bulacan, Cavite, and Laguna. This geographic focus was chosen to capture insights specific to the Philippine context, where private universities play a significant role in delivering higher education. These institutions are primarily influenced by private sector management approaches, making their construction practices a valuable subject for investigation.

The study gathers insights directly from stakeholders such as contractors and construction professionals who have been actively involved in the development of educational facilities in the region. By focusing on the GMA, the research enables a contextual understanding of the construction management policies, frameworks, and challenges faced by private higher education institutions in the Philippines, while also drawing on relevant empirical studies and practices from international contexts.

It is important to note that the findings of this research may not be generalizable to other regions or to non-academic construction projects. Additionally, the analysis is constrained by the availability and accuracy of project data, which may vary across different cases. Lastly, the study is strictly concentrated on overrun analysis and does not extend to broader aspects of project management or construction performance metrics beyond cost and time considerations.

2. METHODOLOGY

2.1 Research Design

This study employs a quantitative research design to develop a comprehensive understanding of project management and construction-related challenges, particularly those contributing to cost and time overruns. The approach leverages the Analytic Hierarchy Process (AHP) to enhance data collection and analysis by enabling structured evaluation of complex decision-making scenarios. This method has been used in several multi-criteria decision studies [9], and suitability mapping studies [10], [11].

The quantitative component of the study involves the use of structured questionnaires distributed to a purposively selected sample of construction industry professionals and project stakeholders in the Greater Manila Area. These instruments were designed to collect numerical data on various dimensions of project management such as planning, scheduling, budgeting, and stakeholder coordination. This approach allows for the measurement and analysis of key variables associated with project execution and overruns.

To support variable selection and focus the AHP framework on the most critical issues, the study employed Pareto analysis, a vital tool in problem-solving and prioritization. Pareto analysis focuses on selecting tasks generating a substantial overall effect. The Pareto chart, a graphical tool, dissects a large problem into its parts, identifying the most critical components. It is commonly referred to as the 80-20 rule, indicates that the majority of the results (80%) stem from the minority of causes (20%). In the context of construction and project management, this is illustrated by instances where a small number of tasks or decisions disproportionately consuming time, resources, or budget [12].

The application of the analysis is simple and involves the following steps:

1. Identify and list problems or causes by identifying the problems or causes affecting the situation and listing them comprehensively.
2. Measure the frequency or impact by gathering data to measure the frequency or impact of each problem or cause.
3. Sort and organize data by arranging the data in descending order, from the most frequent or impactful to the least.
4. Calculate the cumulative percentage by calculating the cumulative percentage for each problem or cause.
5. Create a Pareto Chart by constructing a chart with bars representing the frequency or impact and a line graph showing the cumulative percentage.
6. Analyze and prioritize by examining the chart to identify the top problems or causes, typically those contributing to around 80% of the effect.

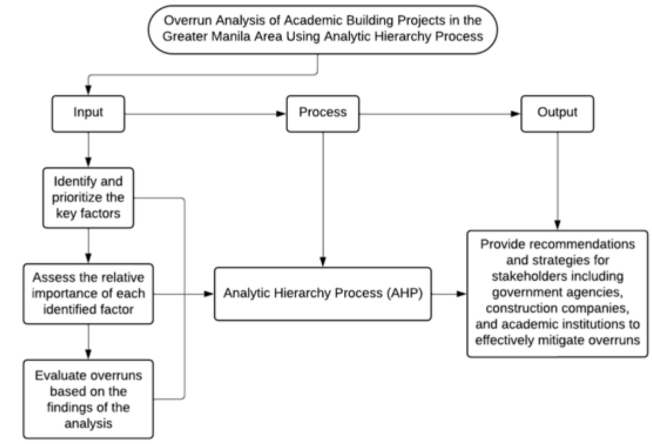

Fig. 2.1.1. Conceptual Framework of the Study.

After narrowing down the key contributors using Pareto analysis, the AHP methodology was applied to derive their relative priority as seen in Figure 2.1.1. AHP is well-suited for evaluating complex, unstructured problems by decomposing them into a hierarchical structure. It enables decision-makers to assign relative importance to each criterion through pairwise comparisons, producing a set of weighted priorities.

Following the standard four-step AHP process [13], the study proceeded as follows:

1. List the decision, alternatives, and criteria in a hierarchical structure.
2. Conduct criteria and alternative judgment through paired comparisons.
3. Determine the priority weight and relative importance of each criterion.
4. Determine the optimal choice by calculating logical consistency.

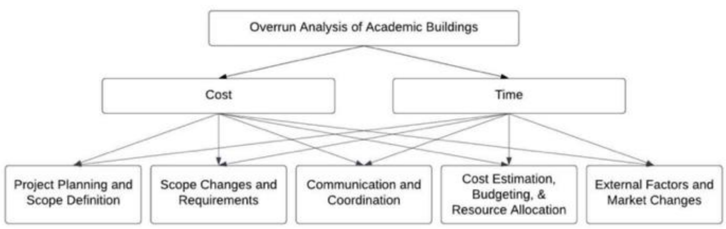

Fig. 2.1.2. Theoretical Framework of the Study.

The steps in the AHP method involve hierarchical order from the problem faced. First, the problem will be solved, described into elements that are criteria and alternative which then structured hierarchy as seen in Figure 2.1.2 Second, is doing criteria judgment and alternative judgment through paired comparison. To ensure clarity, pairwise comparison questions must be conveyed precisely. The scale for evaluation for these comparisons ranges from 1 to 9. A value of 1 denotes equal importance, while 3, 5, 7, and 9 signify increasing levels of importance. In addition, Intermediate values of 2, 4, 6, and 8 are also used for finer distinctions. These values aren't treated as values that are numerical but serve to indicate the relative importance or significance of the metrics in pairwise comparison.

The pairwise comparison matrices were processed to calculate the eigenvectors, which represent the priority weights of each factor. The final step involves determining logical consistency. In decision-making, ensuring consistency is crucial because decisions and judgments based on low to no consistency are unreliable. Consistency is measured using the Consistency Ratio (CR), expressed as CR = CI / RI, where CI and RI are the Consistency Index and Random Index, respectively. The RI values can be found in Table 2.1.1. The CI is calculated using CI = λmax - n / n - 1 and an evaluation is considered acceptable and consistent if the CR value is less than 0.10. If the CR value exceeds 0.10, the pairwise comparisons should be reassessed.

Table 2.1.1. Random Index Table

Matrix size	1	2	3	4	5	6	7	8	9	10
Random Index	0	0	0,52	0,89	1,11	1,25	1,35	1,40	1,45	1,49

2.2 Selection of Factors

A comprehensive literature review was conducted to identify common factors relating to and contributing to project overruns in academic building projects. The reviewed literature provided a list of factors, which were then subjected to a Pareto analysis. The Pareto analysis helped in identifying the most critical factors by their frequency of occurrence in the reviewed literature. Based on the frequencies obtained from the Pareto analysis, five factors were identified as the most critical in contributing to project overruns as seen in Figure 2.2.1.

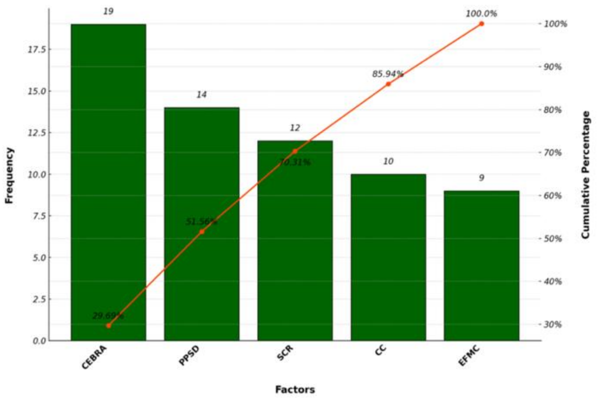

Fig. 2.2.1. Pareto Chart of Factors Contributing to Project Overruns.

Cost Estimation, Budgeting, & Resource Allocation (CEBRA), the highest frequency factor at 19, indicates the critical role of accurate cost estimation, budgeting, and resource allocation, with misestimations and improper budgeting causing financial constraints and delays in project completion. Project Planning and Scope Definition (PPSD), with a frequency of 14, highlights the importance of thorough project planning and clear scope definition to avoid misunderstandings and ensure that all project requirements are met within the allocated time and budget. Scope Changes and Requirements (SCR), with a frequency of 12, underscores the impact of changes in project scope and requirements, as frequent or poorly managed scope changes can lead to significant cost and time overruns. Communication and Coordination (CC), cited 10 times in the literature, emphasizes the need for effective communication and coordination among project stakeholders, as poor communication can lead to misunderstandings, delays, and additional costs. External Factors and Market Changes (EFMC) have been cited 9 times and encompass the impact of market volatility, regulatory alterations, and other unexpected events. These factors can cause disruptions in project schedules and budgets, ultimately resulting in overruns.

2.3 Data Analysis

Quantitative research design is involved in the data analysis for this study. The quantitative data collected from the survey questionnaire and Analytical Hierarchy Process (AHP) is summarized. The survey aimed to capture the judgments of experts on the relative importance of factors contributing to overruns by rating the importance of one factor over another in contributing to either cost or time overruns. Each paired comparison required experts to mark on the scale to indicate their expert judgment. The factors included in the survey were Project Planning and Scope Definition (PPSD), Scope Changes and Requirements (SCR), Communication and Coordination (CC), Cost Estimation, Budgeting, and Resource Allocation (CEBRA), and External Factors and Market Changes (EFMC).

Each expert individually completed the questionnaire, and their judgments were subsequently entered into the Expert-choice Software and SpiceLogic AHP Process Software. These tools were used to calculate pairwise comparison matrices, priority weights, and consistency ratios. A comprehensive interpretation of the data and addressing of the research objectives is provided by the findings from the quantitative analysis. Rigorous standards of validity, reliability, and transparency are adhered to in the data analysis process to ensure the accuracy and credibility of the findings.

The study adheres to ethical guidelines and regulations set by relevant research ethics committees and institutions. Transparency and honesty are maintained in reporting the findings, and the researcher ensures accurate representation and interpretation of the data.

3. RESULTS AND DISCUSSION

3.1 Demographic Profile of Experts

The results of this study align with its objective to analyze cost overruns in academic building projects in the Greater Manila Area (GMA) using the Analytic

Hierarchy Process (AHP). Eleven experts with extensive experience in academic construction contributed, representing diverse firms including a Property Management Corporation (1 expert), Construction Management (2), Construction Management (2), Design Firm (3), and Project Management Office (3). Their expertise spans two key project phases: pre-construction (3 experts from Design Firm) and construction implementation (8 experts from the other firms). Their roles cover a wide range of specializations, such as architecture, structural and geotechnical engineering, project management, and MEPFS engineering. Experience levels range from 5 to over 15 years, ensuring informed insights specific to academic projects in locations including Manila, Biñan, Batangas, and Taguig City. This diverse and experienced panel underpins the credibility and depth of the AHP findings.

3.2 Analysis Using Analytic Hierarchy Process

Upon collecting the expert results, these values were subjected to pairwise comparison matrices for each pair of factors contributing to both cost and time overruns were constructed. Subsequently, the priority weights with consistency ratios were calculated, providing a quantified measure of their relative importance. These weights were essential for identifying and prioritizing the most critical factors contributing to overruns in academic building projects in the Greater Manila Area (GMA).

Table 3.2.1 Normalized Pairwise Comparison Matrix for Cost Overruns

Factors	PPSD	SCR	CC	CEBRA	EFMC
Project Planning and Scope Definition	0.5122	0.8122	0.5833	0.3134	0.1429
Scope Changes and Requirements	0.0732	0.1160	0.2917	0.3134	0.5000
Communication and Coordination	0.0854	0.0387	0.0972	0.3134	0.0714
Cost Estimation, Budgeting, & Resource Allocation	0.0732	0.0166	0.0139	0.0448	0.2143
External Factors and Market Changes	0.2561	0.0166	0.0139	0.0149	0.0714

The expert ratings were used to construct the pairwise comparison matrices, which were then normalized by dividing each element by the sum of its respective column. This process ensures that the sum of each column in the matrix is equal to one, facilitating the comparison of different factors on a common scale as seen in Table 3.2.1.

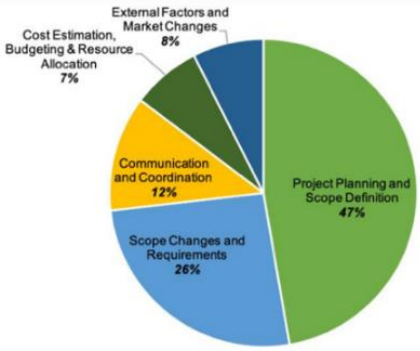

Fig. 3.2.1. Proportion of Priority Weights of Factors for Cost Overruns

Among the five factors assessed, Project Planning and Scope Definition (PPSD) emerged as the most significant contributor to cost overruns, with a priority weight of 0.4728 (47%). This was followed by Scope Changes and Requirements (SCR) at 0.2589 (26%), Communication and Coordination (CC) at 0.1212 (12%), External Factors and Market Changes (EFMC) at 0.0746 (8%), and Cost Estimation, Budgeting, & Resource Allocation (CEBRA) at 0.0725 (7%) (see Fig. 3.2.1). To ensure the reliability of the pairwise comparison matrices and priority weights, a consistency check was performed, involving the calculation of the consistency index (CI) and the consistency ratio (CR). The acceptable CR value is usually less than 0.1, indicating a reasonable level of consistency in the judgments. For the cost overruns matrix, the consistency check results were λmax of 5.37, CI of 0.0925, and CR of 0.0825. The CR value being less than the acceptable limit of 0.1 indicates that the pairwise comparisons provided by the experts are consistent.

Table 3.2.2 Normalized Pairwise Comparison Matrix for Time Overruns

Factors	PPSD	SCR	CC	CEBRA	EFMC
Project Planning and Scope Definition	0.3600	0.7975	0.4615	0.1233	0.1250
Scope Changes and Requirements	0.0400	0.0886	0.1538	0.5753	0.5833
Communication and Coordination	0.1200	0.0886	0.1538	0.1644	0.0833
Cost Estimation, Budgeting, & Resource Allocation	0.2400	0.0127	0.0769	0.0822	0.1250
External Factors and Market Changes	0.2400	0.0127	0.1538	0.0548	0.0833

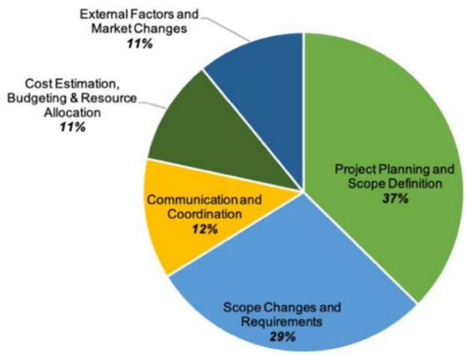

Fig. 3.2.2. Proportion of Priority Weights of Factors for Time Overruns

The priority weights, representing the relative importance of each factor, were once again calculated by averaging the normalized values of each row. The results indicate that for time overruns, Project Planning and Scope Definition (PPSD) also has the highest priority with the value of 0.3735 (37%), followed by Scope Changes and Requirements (SCR) with 0.2882 (29%), Communication and Coordination (CC) with 0.1220 (12%), External Factors and Market Changes (EFMC) with 0.1089 (11%), and Cost Estimation, Budgeting,

& Resource Allocation (CEBRA) with 0.1074 (11%) as seen in Figure 3.2.2, highlighting the critical areas that need focus to effectively mitigate time overruns.

To ensure the reliability of the pairwise comparison matrices and priority weights, a consistency check was once again performed, involving the calculation of the consistency index (CI) and the consistency ratio (CR). For the time overrun matrix, the consistency check results were λmax of 5.394, CI of 0.0985, and CR of 0.0879. The CR value being less than the acceptable limit of 0.1 indicates that the pairwise comparisons provided by the experts are consistent. This adds confidence to the findings, confirming that the expert-derived weights form a robust foundation for decision-making.

By aggregating the priority weights from cost overruns and time overruns, the overall importance of each factor contributing to overruns in academic building projects in the Greater Manila Area (GMA) was aimed to be identified. To aggregate the priority weights, the priorities for each factor across both cost overruns and time overruns were simply averaged. This approach ensured that the significance of each factor contributing to overruns in academic building projects in the GMA was accounted for, providing a comprehensive understanding of their impact.

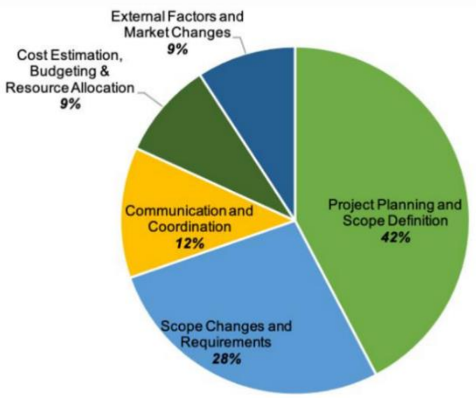

Fig. 3.2.3. Proportion of Combined Priority Weights of Factors for Overruns

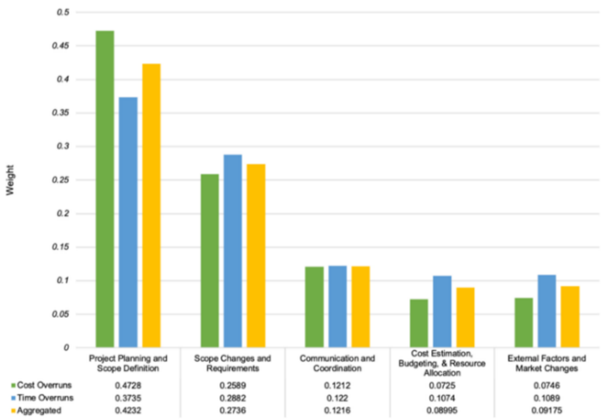

Fig. 3.2.4. Combined Priority Weights of Factors for Overruns

The proportion of combined priority weights were calculated by multiplying the combined weight of each factor by 100 across both cost overruns and time overruns. The results indicate that for factors contributing to overruns in academic building projects in the GMA, Project Planning and Scope Definition (PPSD) has the largest proportion at 42%, followed by ScopeFull-length papers generally consist of introduction, materials, methods, results and discussion in addition to references section. Changes and Requirements (SCR) at 28%, Communication and Coordination (CC) at 12%, External Factors and Market Changes (EFMC) at 9%, and Cost Estimation, Budgeting, & Resource Allocation (CEBRA) also at 9% as seen in Figure 3.2.3, highlighting the critical areas that need focus to effectively mitigate factors contributing to overruns in academic building projects in the GMA.

The analysis revealed that Project Planning and Scope Definition (PPSD) is the most critical factor, followed by Scope Changes and Requirements (SCR). These findings emphasize the importance of meticulous planning and scope management in mitigating and analyzing overruns and achieving successful project outcomes in academic building projects in the Greater Manila Area (GMA). PPSD is critical in academic building projects due to their strict timelines, which must align with the academic calendar, typically starting in August or September. Proper planning ensures construction is completed before the start of classes, thereby avoiding disruptions in the academic schedule. A well-defined scope sets clear expectations and milestones, reducing the chances of delays and cost overruns. Smith and Love (2004) highlight that effective project planning and scope management are essential for meeting deadlines and ensuring the functional and timely delivery of academic facilities. Research indicates that comprehensive project planning is fundamental in construction projects to mitigate risks and manage unforeseen challenges [14]. In academic building projects, the need for precise planning is even more pronounced due to the complex requirements of educational facilities and the high expectations for timely completion [15] SCR significantly impact academic building projects, given the unique requirements of educational facilities such as specialized classrooms, laboratories, and other academic spaces. Managing these changes effectively is crucial to prevent delays and additional costs. Olaniran [16] notes that scope management is particularly challenging in academic settings, where user requirements may evolve during the project lifecycle. Furthermore, academic institutions often have multiple stakeholders, including faculty, students, and administrative staff, each with unique needs and expectations, complicating the scope definition and management process [17]. In the Greater Manila Area, where the demand for state-of-the-art educational facilities is high, scope changes are common as institutions strive to stay current with educational trends and technological advancements. Addressing these evolving requirements promptly ensures that the facilities meet the needs of the academic community and adhere to the planned timelines and budgets [18].

Effective clear communication among project stakeholders, including educational institutions, contractors, and regulatory bodies, are vital for academic building projects. Clear communication ensures that all parties are aligned with project goals and timelines. Loosemore and Chin Leung [20] emphasize that coordination in academic projects is crucial to incorporate feedback from various stakeholders, including faculty and administrative staff, to meet their specific needs. Ineffective communication can lead to misunderstandings, errors, and delays, which are particularly detrimental in the context of academic buildings where precision and adherence to the project timelines are critical [21]. In the Greater Manila Area, where projects must adhere to local regulations and often involve multiple government agencies, effective coordination is essential to navigate bureaucratic processes and ensure timely approvals and compliance [22], [23].

EFMC such as economic fluctuations and changes in educational policies, can affect academic building projects. These factors may impact material costs, labor availability, and regulatory requirements, leading to potential overruns. The Central Bank of The Philippines [24] stress the importance of monitoring these external influences and incorporating flexibility into project plans to mitigate their impact. In the Greater Manila Area, external factors such as typhoons, which are common during the rainy season, can also impact construction timelines. Incorporating contingency plans and flexible scheduling can help mitigate these risks and ensure that projects stay on track for their intended completion dates.

Accurate CEBRA is essential for academic building projects to ensure financial resources are adequately managed. Misestimations can lead to funding shortfalls, causing delays and incomplete projects. Ahiaga-Dagbui and Smith [25] highlight the importance of precise budgeting and resource planning in academic construction to avoid financial constraints that can hinder project completion. Accurate cost estimation is particularly critical in academic projects where budgets are often tight, and financial oversight is rigorous [26]. In the Greater Manila Area, where construction costs can be influenced by fluctuating material prices and labor costs, diligent financial planning and regular budget reviews are necessary to accommodate these variations and ensure projects are completed within the allocated budget and timeframes.

For further analysis, the expert results were divided into two categories to represent what phase of construction the experts are involved in. Specifically, experts from the Design Firm are involved in pre-construction phase, while eight (8) experts from Construction Managers and Project Management are primarily involved in the construction implementation phase. The expert result values from both phases were also entered into the Expert-choice Software and SpiceLogic AHP Process Software, where pairwise comparison matrices for each pair of factors contributing to both cost and time overruns were constructed.

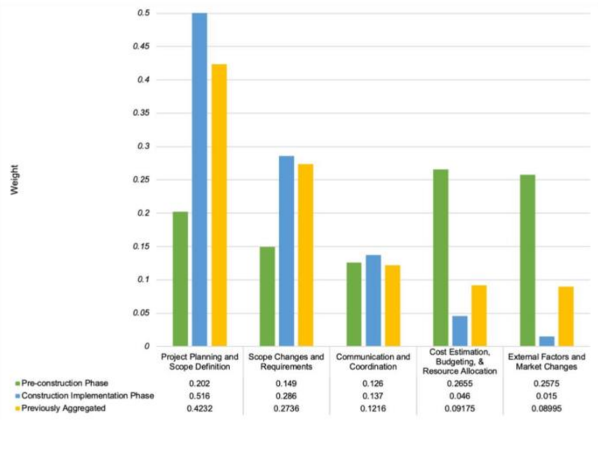

Fig. 3.2.5. Combined Priority Weights of Factors for Overruns (Pre-construction and Construction (Implementation Phases)

The pre-construction phase for academic building projects in the Greater Manila Area (GMA) highlights that Cost Estimation, Budgeting, & Resource Allocation (CEBRA) is the most critical factor, with a priority weight of 0.2655 (27%). Closely following is External Factors and Market Changes (EFMC) with a weight of 0.2575 (26%). Project Planning and Scope Definition (PPSD), with a weight of 0.202 (20%). Scope Changes and Requirements (SCR), weighing 0.149 (15%). Communication and Coordination (CC), the least critical factor at 0.126 (12%). Meanwhile, the construction implementation phase for academic building projects in the GMA reveals that Project Planning and Scope Definition (PPSD) is the most critical factor, with a priority weight of 0.516 (52%). Following PPSD, Scope Changes and Requirements (SCR) holds a weight of 0.286 (29%). Communication and Coordination (CC), with a weight of 0.137 (14%). Cost Estimation, Budgeting, & Resource Allocation (CEBRA) is less critical in this phase, with a weight of 0.046 (4%). External Factors and Market Changes (EFMC) have the lowest weight of 0.015 (1%).

In academic building projects in the Greater Manila Area (GMA), accurate cost estimation and budgeting during the pre-construction phase are critical, as they form the project's financial foundation. Inaccuracies at this stage often lead to cost overruns, especially given local fluctuations in material and labor costs [27],[28]. External factors such as inflation and currency changes must be considered to create realistic budgets [29]. While Project Planning and Scope Definition (PPSD) remains important, it ranks behind budgeting and external factors in this phase. Nevertheless, proper planning and clear scope definition help prevent delays and scope creep [30]. Scope Changes and Requirements (SCR) and Communication and Coordination (CC) are less urgent but require early preparation to handle later changes effectively [32],[33].

During the construction implementation phase, PPSD becomes the most critical factor as it ensures that the project follows the defined plan and scope, minimizing deviations and ensuring adherence to the timeline and budget. According to Kerzner [14], effective project planning directly correlates with successful project outcomes during implementation. In the fast-paced construction environment of Greater Manila, sticking to the defined plan is vital to meet tight deadlines and avoid penalties [31],[36]. Managing SCR becomes more crucial during construction to avoid disruptions, additional costs, and delays. This phase requires adaptability to changes that occur and effective management of these changes. Research by Hanna et al. [30] illustrates how scope changes during construction can significantly impact project performance. In the local context, frequent coordination meetings and stakeholder consultations help manage scope changes effectively [3]. Effective CC is vital during construction to ensure all stakeholders are aligned, and any issues are promptly addressed. While still important, CEBRA ranks lower during the construction phase because the focus shifts to managing the already allocated resources rather than estimating costs. The significance of this shift is discussed by Hwang and Ng [35], who note that cost management becomes a matter of controlling expenses rather than estimating them during construction. In the Philippines, effective resource management ensures that projects remain within budget despite rising costs. EFMC is less critical during construction as most external influences would have been accounted for during the pre-construction phase. However, unexpected changes can still impact the project. In the Greater Manila Area, unforeseen events such as extreme weather conditions or sudden policy changes can still pose challenges, requiring contingency plans to be in place [37].

The study's AHP results reflect these shifts. Combined weights placed PPSD highest (42%), followed by SCR (28%), CC (12%), EFMC (9%), and CEBRA (9%). Phase-specific results showed CEBRA and EFMC as top priorities in pre-construction, while PPSD and SCR dominated during construction. These findings emphasized the importance of meticulous planning and scope management in mitigating and analyzing overruns. Additionally, the study underscores the dynamic nature of overruns and the need to tailor management strategies to each project phase in the GMA.

4. CONCLUSION

This study analyzed the factors contributing to cost and time overruns in academic building projects in the Greater Manila Area (GMA) using the Analytic Hierarchy Process (AHP). Through a structured methodology, five key factors were identified, evaluated, and prioritized based on expert input: Project Planning and Scope Definition (PPSD), Scope Changes and Requirements (SCR), Communication and Coordination (CC), External Factors and Market Changes (EFMC), and Cost Estimation, Budgeting, and Resource Allocation (CEBRA).

PPSD emerged as the most critical factor, with a combined priority weight of 42%, highlighting the importance of detailed planning and clear scope definition. SCR followed at 28%, underscoring the need for strong change management practices. CC, EFMC, and CEBRA ranked lower but remained influential, with respective weights of 12%, 9%, and 9%. Phase-specific analysis revealed that CEBRA and EFMC are more significant during the pre-construction phase, while PPSD and SCR dominate the construction implementation phase. This emphasizes the dynamic nature of project management and the need for tailored strategies at each stage. This assessment allows stakeholders to focus on the most critical areas, particularly project planning and scope definition, to mitigate overruns effectively. The study evaluated the extent of overruns in academic building projects and provided targeted recommendations to address these issues. By focusing on the highest priority areas, stakeholders can implement strategies to reduce the likelihood of overruns, thereby improving project outcomes.

This study's findings hold substantial importance for stakeholders engaged in academic building projects in the Greater Manila Area (GMA). Effective project planning and scope management are paramount to preventing overruns. Stakeholders must invest in comprehensive planning processes, including the development of a Work Breakdown Structure (WBS), detailed timelines and milestones, resource allocation plans, risk management strategies, and contingency plans. Robust change management practices are also essential, encompassing clear deliverables, thorough analysis of change implications, updated estimates, and the establishment of a Change Control Board (CCB) to oversee changes. Improving communication and coordination among project teams is crucial. Regular meetings, clear reporting lines, and the use of project management tools can enhance stakeholder coordination, alongside key performance indicators (KPIs) to monitor progress. Additionally, anticipating external factors such as market volatility, regulatory changes, and unforeseen events can mitigate potential impacts on both cost and time. Accurate cost estimation and budgeting are also critical. Utilizing historical data and industry benchmarks, along with conducting thorough budget and cost audits, can help compare actual expenditures against planned budgets. By addressing these critical areas, construction firms, educational institutions, and other stakeholders can reduce the risk of budget and time deviations, ultimately leading to more successful project completions. The insights derived from this study can provide a basis for creating best practices and guidelines for managing academic building projects, ensuring they are finished on schedule, within budget, and meet the required quality standards.

5. REFERENCES

[1] B. Flyvbjerg, M.S Holm, S. Buhl, Underestimating costs in public works projects: Error or lie? Journal of the American Planning Association, 68(3), (2002) 279–295. https://doi.org/10.1080/01944360208976273

[3] J. R. Tolentino, Exploring delay and cost overrun issues in Philippine infrastructure projects. Philippine Journal of Public Administration, 64(2), 189–210 (2020). Retrieved from https://journals.upd.edu.ph/index.php/pjpa

[5] Smith, J., & Love, P. E. D. (2004). Stakeholder management during project inception: Strategic needs analysis. Journal of Architectural Engineering, 10(1), 22–33. https://doi.org/10.1061/(ASCE)1076-0431(2004)10:1(22)

[6] O. J. Olaniran, A study of project failure in construction industry in Nigeria. International Journal of Business and Management Review, 3(9), 1–20. (2015) Retrieved from https://www.eajournals.org

[7] A.M.S. Mohammed, T. Ukai, Where to build? A suitability Modelling Approach for University Campuses Location Allocation in Japan. Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 9. (2023) 93-100.

[8] F. Peldschus, L. Ozdamar, Multi-criteria evaluation and decision-making in construction project management using AHP. Technological and Economic Development of Economy, 17(3), (2011) 501–517. https://doi.org/10.3846/20294913.2011.603175

[9] A.R.H Delfin, A.M.A. Salazar, E.D. Doria, J.L.E. Gesta, Assessment of Household Flood Vulnerability in Panaytayon, RTR Using Multi-Criteria Decision Making and Geographic Information Systems (GIS) Techniques, Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 10, pp.440-447, 2024-10-17.

[10] A. G. Cauba Jr., C.D. Cunanan, R.B. Monteclaro, Using GIS and Analytical Hierarchy Process (AHP) For Suitability Mapping of Potential Sites of Bamboo Species Plantation in Agusan Del Norte, Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 10, pp.319-324, 2024-10-17.

[11] A.J.B. Felipe, J.G. Magallanes, M.P. Abriol, Suitability Evaluation of Existing Agrometeorological Network in Luzon, Philippines Using GIS-based Analytical Hierarchy Process (AHP), Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 10, pp.48-53, 2024-10-17.

[12] J. Stojčetović, V. Jeremić, T. Radojević, Application of Pareto analysis in a project management environment: A case study. Serbian Journal of Management, 10(2), (2015) 207–218. https://doi.org/10.5937/sjm10-7115

[13] L. Joselin, J. Tania, Merry, W.Rusli, E. Bahri, D. Sitanggang, M. Turnip, The Implementation of Analytical Hierarchy Process for Determining Best Employee. Journal of Physics: Conference Series. 1230. 012071. 10.1088/1742-6596/1230/1/012071.

[16] O.J. Olaniran,. Barriers to managing cost overrun in construction projects. Journal of Construction Engineering, (2015), 1–9. https://doi.org/10.1155/2015/534123

[17] K.Y. Mok, G.Q. Shen, R.J. Yang, Stakeholder management studies in mega construction projects: A review and future directions. International Journal of Project Management, 33(2), (2015), 446–457.

[20] M. Loosemore, T. Chin Leung, The influence of communication on construction site safety. Construction Management and Economics, 18(6), (2000), 631–640.

[23] J. Tolentino, Project governance and stakeholder engagement in Philippine construction. Philippine Construction Review, 12(3), 2020, 34–41.

[24] S.R. Toor, S.O. Ogunlana, 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), (2009). 228–236.

[25] D.D. Ahiaga-Dagbui, S.D. Smith, Rethinking construction cost overruns: Cognition, learning and estimation. Journal of Financial Management of Property and Construction, 19(1), (2014), 38–54.

[29] A.S. Ali, S.N. Kamaruzzaman, H. Salleh, The causes and impacts of cost overrun on construction projects in Malaysia. Journal of Facilities Management, 16(1), (2018). 75–85.

[30] M. Marzouk, T. El-Rasas, Analyzing delay causes in Egyptian construction projects. Journal of Advanced Research, 5(1), (2014) 49–55.

[32] C. W. Ibbs, C. K. Wong, Y. H. Kwak, Project change management system. Journal of Management in Engineering, 17(3), (2007) 159–165.

[33] G. Ofori, Leadership for future construction industry: Agenda for authentic leadership. International Journal of Project Management, 34(7), (2016) 1415–1436.

[34] A. S. Hanna, W. B. Lotfallah, M. J. Lee, Statistical-fuzzy approach for assessing impacts of change orders. Journal of Construction Engineering and Management, 128(1), (2002) 57–64.

[35] B. G. Hwang, W. J. Ng,. Project management knowledge and skills for green construction: Overcoming challenges. International Journal of Project Management, 31(2), (2013) 272–284.

Reference to a book:

[14] H. Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling (12th ed.). John Wiley & Sons, 2017.

[15] A. Walke, Project Management in Construction (6th ed.). Wiley-Blackwell, 2015.

[21] Dainty, A. R. J., Moore, D. R., & Murray, M. (2006). Communication in Construction: Theory and Practice. Routledge.

[26] Ashworth, A., Hogg, K., & Higgs, C. (2013). Willis's Practice and Procedure for the Quantity Surveyor (13th ed.). Wiley-Blackwell.

Reference to a website:

[1] CHED. (2023). Commission on Higher Education Annual Report 2023. Commission on Higher Education, Philippines. Retrieved from https://ched.gov.ph

[4] Manila Bulletin website: Cost overruns and project delays plague PH school infrastructure projects. Manila Bulletin News. Retrieved from https://mb.com.ph

[18] Commission on Higher Education. (2023). CHED Strategic Plan and Updates. Retrieved from https://ched.gov.ph

[19] Bautista, C. (2021). The future of higher education infrastructure in the Philippines. Manila Bulletin, August 2021. Retrieved from https://mb.com.ph

[22] Manila Bulletin. (2023). Construction sector urged to improve project coordination. Manila Bulletin, October 2023. https://mb.com.ph

[27] Philippine Statistics Authority website: ttps://psa.gov.ph Construction Materials Price Index (CMPI). (accessed 10.24.2024)

[28] Bangko Sentral ng Pilipinas website, Inflation Reports and Forecasts. Retrieved from https://bsp.gov.ph (accessed 02.01.2025)

[31] Department of Public Works and Highways (DPWH). (2023). Construction Guidelines and Infrastructure Development Updates. Retrieved from https://dpwh.gov.ph

[36] Philippine Contractors Accreditation Board (PCAB) Licensing and Compliance Guidelines website: https://pcabgovph.com

[37] PAGASA Website on Climate Outlook and Weather Risk Reports: https://bagong.pagasa.dost.gov.ph ((accessed 10.20.2024)