



External Factors Affecting the Construction Management of Large-Scale Airport Buildings in Thailand

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Abstract

Background and Aims: Large-scale airport projects are highly complex and susceptible to various external disruptions. This research aims to investigate the impacts of two specific external factors—severe diseases and natural disasters, and legal and regulatory factors—on the construction management of large-scale airport buildings, specifically focusing on their influence on work delays, cost management, and work quality.



Methodology: Data were collected from 73 project stakeholders, including owners, designers, project management consultants, construction supervisors, and contractors. A purposive sampling method was employed to ensure that the sample consisted exclusively of professionals with direct, specialized experience in large-scale airport construction, making the findings highly representative of the project's operational environment. The study utilized descriptive statistics, One-Way ANOVA (F-test) to examine differences in professional perceptions based on demographic backgrounds, and Pearson correlation analysis to determine the strength of the relationships between the identified impact areas.

Results: The findings reveal that external factors significantly impact both work delays and cost management, with "severe diseases and natural disasters" identified as the primary factor yielding the highest mean scores. In contrast, the impact on work quality was found to be at a moderate level. Statistical analysis indicates that educational background significantly influences the perception of impacts from severe diseases and natural disasters regarding work delays and cost management, while work experience and job roles do not create statistically significant differences. Furthermore, a strong positive correlation was observed between work delays and cost management ($r = 0.924$, $p < 0.01$), followed by correlations between cost management and work quality ($r = 0.746$, $p < 0.01$), and work delays and work quality ($r = 0.744$, $p < 0.01$).

Conclusion: External factors, particularly natural disasters, severe diseases, and legal and regulatory requirements, serve as critical disruptors in large-scale airport construction management. The strong positive correlation between delays and cost overruns underscores the necessity for proactive management strategies to mitigate these risks. Project managers should prioritize contingency planning and adaptability to minimize the cascade effect these external factors have on both budget and schedule, regardless of the team's professional tenure.

Keywords: Severe Diseases and Natural Disasters; Legal and Regulatory Factors; Airport Construction; Work Delays; Cost Management; Work Quality; Risk Management.



Introduction

The aviation industry in Thailand plays a pivotal role in driving the nation's economy, generating substantial revenue not only from passenger transport but also from supporting the tourism sector, which serves as a primary source of national income. The growth and prosperity of this industry inherently depend on four core components: airlines, aircraft, airports, and aviation facilities.

Between 2008 and 2017, the expansion of the aviation industry was primarily driven by the emergence of low-cost carriers (LCCs), which democratized air travel, lowered transit costs, and precipitated a rapid surge in passenger volume. By 2015, both passenger numbers and flight frequencies had doubled compared to 2010 levels, propelling Thailand's growth rate beyond global and Asia-Pacific regional averages. This growth necessitated the expansion of airport infrastructure to accommodate the influx of passengers. For instance, Suvarnabhumi Airport, which opened in 2006 with an initial designed capacity of 45 million passengers per annum, already experienced an overcapacity of 46 million passengers by 2007, with a continuous upward trend annually. This underscores the direct correlation between aviation business growth and the requisite expansion of airport capacity. Consequently, in 2010, the government approved a resolution to upgrade the airport's capacity from 45 million to 60 million passengers per year to alleviate congestion, leading to the construction of the Midfield Satellite 1 (SAT-1) concourse extension (Civil Aviation Authority of Thailand, 2019).

However, while infrastructure expansion is critical to accommodate this growth, large-scale airport construction projects frequently face significant challenges, often leading to project delays, cost overruns, and compromised work quality (Smith & Jones, 2021; Thai Department of Civil Aviation, 2022). Although extensive research has explored general construction management, there remains a notable research gap regarding the impact of uncontrollable external factors on the unique environment of airport infrastructure. Current literature often prioritizes general economic or political indicators, yet it frequently overlooks the immediate, disruptive impact of severe diseases, natural disasters, and the volatility of legal and regulatory frameworks in the Thai context.

This study, therefore, aims to bridge this gap by analyzing two critical external factors: (1) severe diseases and natural disasters, and (2) legal and regulatory factors.



These factors were selected due to their unique, unpredictable nature and their profound impact on construction supply chains and labor stability—challenges that are inherently different from typical economic fluctuations (Wang et al., 2023). Furthermore, the complexities surrounding the legal and regulatory requirements for airport construction in Thailand present unique structural barriers that demand specific investigation (Somchai, 2020).

Consequently, this study evaluates the influence of these specific external factors on the Construction Management of Large-Scale Airport Buildings, with a primary focus on three performance dimensions: work delays, cost management, and work quality. By addressing these variables, this research aims to provide actionable insights for project managers to enhance resilience and ensure the successful delivery of critical aviation infrastructure.

Research Objectives

1. To evaluate and compare the impact levels of the Construction Management of Large-Scale Airport Buildings across different demographic profiles of the respondents.
2. To analyze the impact of external factors on the Construction Management of Large-Scale Airport Buildings regarding work delays.
3. To analyze the impact of external factors on the Construction Management of Large-Scale Airport Buildings regarding cost management.
4. To analyze the impact of external factors on the Construction Management of Large-Scale Airport Buildings regarding work quality.

Research Hypotheses

1. Hypothesis 1 (H1) Respondents with different demographic profiles perceive the impacts on the Construction Management of Large-Scale Airport Buildings differently.
2. Hypothesis 2 (H2) Different external factors have varying levels of impact on the construction management of large-scale airport buildings.
3. Hypothesis 3 (H3) Legal, regulatory, and environmental factors (including severe diseases and natural disasters) have a significant impact on construction project outcomes, specifically in terms of work delays, cost management, and work quality.



4. Hypothesis 4 (H4) There is a significant correlation between external factors and the management of work delays, cost overruns, and quality deficiencies in large-scale airport construction.

Literature Review

This study establishes its theoretical foundation by examining the critical components of construction management, project performance indicators, and the external variables that influence large-scale airport infrastructure projects.

1. Construction Management and Project Performance

Construction management is defined as the strategic integration of knowledge, skills, tools, and techniques to manage project activities effectively within scope, time, budget, and quality requirements (Kajornnan, 2008). In the context of large-scale infrastructure, efficient management relies on systematic administration, such as the POSDCoRB framework proposed by Urwick and Gulick (1937), which emphasizes planning, organizing, and coordinating. However, research by Safaa Adnan Mohammed and Afrah Hasan (2024) indicates that large-scale construction projects frequently face performance deviations, such as work delays, cost overruns, and quality deficiencies, often stemming from poor planning and resource mismanagement. These indicators—delay, cost, and quality—serve as the core metrics for assessing project success, as corroborated by Obondi (2020), who highlighted that effective project risk monitoring is significantly positively correlated with construction project success.

2. External Risk Factors and Airport Construction

Airport construction is uniquely complex due to the requirement for integration with existing commercial airport operations. Utilizing PESTEL analysis (Rothaermal, 2017), external factors are categorized as uncontrollable variables that significantly affect project efficiency. Among these, legal and regulatory frameworks are paramount, especially regarding construction within restricted areas, such as the "Air Side," which necessitates strict compliance with aviation safety protocols and labor laws (Pittayasophonkit, 2011). Furthermore, environmental factors—specifically severe diseases and natural disasters—pose unpredictable threats. Worawoot Chetnarong et al. (2024) provided empirical evidence that the COVID-19 pandemic caused significant



disruptions in airport construction projects in Thailand between 2019 and 2023, accounting for nearly 19% of contract extension requests and negatively impacting both human resources and material supply chains.

3. Conceptual Framework

Drawing on these theoretical insights, this study establishes the conceptual framework presented in Figure 1. The model illustrates the interaction between internal factors (personnel, contract management, and project resources) and external factors (severe diseases, natural disasters, and legal/regulatory requirements) and their subsequent impact on three critical management performance indicators: work delays, cost management, and work quality. The framework assumes that internal management strategies are often constrained by the volatile nature of these external variables. By analyzing these relationships, this research aims to identify critical factors that lead to performance deviations, thereby providing a basis for developing more resilient project management strategies for future large-scale airport developments.

Independent Variables Dependent Variables

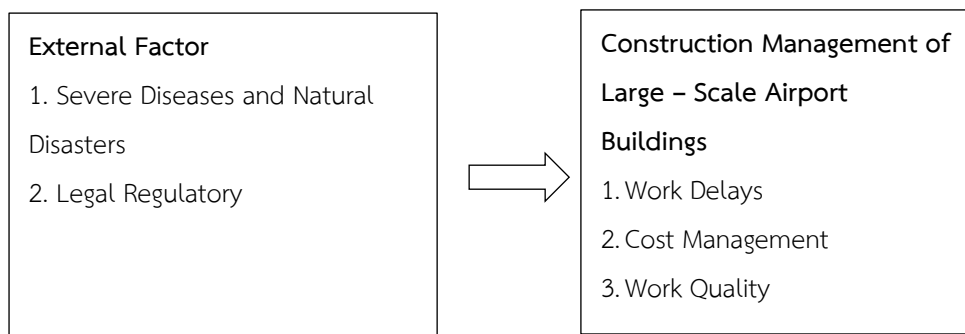


Figure 1 Conceptual Framework

Research Methodology

1. Materials and Methods

This study utilizes a quantitative research design to analyze the impact of external factors specifically severe diseases, natural disasters, and legal/regulatory frameworks—on the Construction Management of Large–Scale Airport Buildings, focusing on work



delays, cost management, and work quality. A purposive sampling method was employed to select 73 key project stakeholders, including Owners, Designers, Project Management Consultants, Construction Supervisors, and Contractors. This sample size was deemed sufficient for this analysis as the population consists of specialized professionals with direct, unique experience in large-scale airport construction, making the data highly representative of the project's actual operational environment. Furthermore, to ensure the ethical integrity of the study, the research protocol was officially approved by the Institutional Review Board (Human Research Ethics Certification No. COA No.029 RUMUTTO No.031/2025_exp).

Section 1 gathers the demographic information of the respondents, including their education background, work experience, Project Stakeholder Groups, and Project Involvement in the Construction Management of Large Scale Airport Buildings.

Section 2 assesses the impacts of external factors on Construction Management of Large – Scale Airport Buildings across three dimensions: work delays, cost management, and work quality. This section utilizes close-ended questions based on a 5-point Likert rating scale, where responses are scored as follows: 5, 4, 3, 2, and 1.

2. Research Instruments and Validation

The primary research instrument was a structured questionnaire divided into two sections designed to capture comprehensive data regarding project management challenges.

Section 1 collected demographic data, including the respondents' educational background, work experience, stakeholder group affiliation, and their direct involvement in the Construction Management of Large–Scale Airport Buildings.

Section 2 assessed the impacts of external factors (severe diseases, natural disasters, and legal/regulatory frameworks) on construction management across three dimensions: work delays, cost management, and work quality. This section utilized a 5-point Likert rating scale, where 5 indicated the "highest impact" and 1 indicated "no impact".

The instrument's content validity was verified by three experts in the field of construction and project management. The assessment resulted in an Item-Objective Congruence (IOC) index of 0.95, confirming that all items were highly relevant and



consistent with the research objectives. Furthermore, the reliability of the instrument was tested using Cronbach's alpha coefficient for Section 2, yielding a value of 0.88, which indicates high internal consistency and reliability for the collected data. No reliability testing was performed on Section 1, as demographic questions do not require internal consistency measurement.

3. Data Analysis

The collected data were statistically analyzed using SPSS software. Descriptive statistics, including percentage, mean ($\bar{X}$), standard deviation (SD), and variance, were utilized to describe the respondents' profiles and impact levels. To interpret the mean scores, the following criteria were established

4.21 – 5.00 indicates the highest impact.

3.41 – 4.20 indicates a high impact.

2.61 – 3.40 indicates a moderate impact.

1.81 – 2.60 indicates a low impact.

1.00 – 1.80 indicates no impact.

Furthermore, to prioritize the critical factors influencing construction management, the Relative Importance Index (RII) was employed. Inferential statistics, including the One-Way Analysis of Variance (One-Way ANOVA: F-test) and Pearson correlation coefficient (r), were also used to test the research hypotheses regarding differences in perceptions among stakeholder groups and the relationships between variables. In summary, this methodological approach ensures that the findings are both statistically robust and ethically sound.

Research Results

1. Respondents' Professional Profiles

Based on the data analysis, the findings are categorized according to the respondents' professional profiles as follows

1.1 Education Background (Figure 2) The majority of respondents hold a Bachelor's degree (57.5%), followed by a Postgraduate degree (37.0%), and those with below-bachelor's degree qualifications (5.5%).



1.2 Work Experience (Figure 3) A significant majority of the respondents (76.7%) possess more than 20 years of work experience, while 20.5% have between 10–20 years, and only 2.7% have less than 10 years.

1.3 Project Stakeholder Groups (Figure 4) The sample consists of Contractors (54.8%), Employers/Clients (15.1%), Construction Supervisors (15.1%), Project Consultants (12.3%), and Designers/Architects (2.7%).

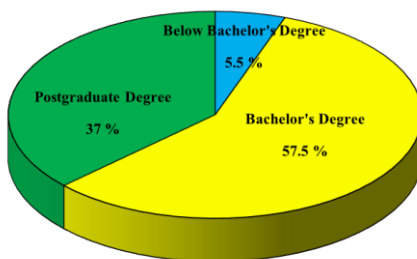


Figure 2 Education Background

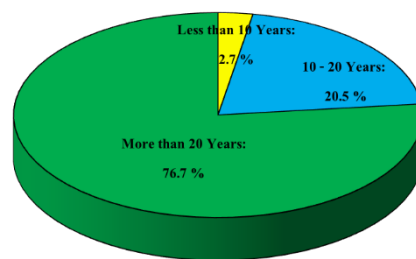


Figure 3 Work Experience

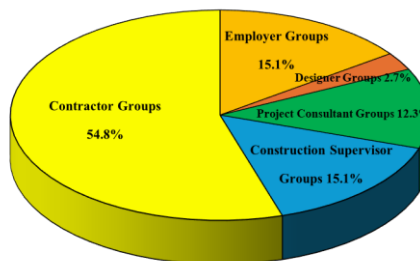


Figure 4 Project Stakeholder Groups

It is important to note that the sample is heavily skewed toward highly experienced professionals, with over 76% of respondents having more than 20 years of experience. While this concentration of senior expertise ensures that the data reflects a deep understanding of complex construction management challenges in large-scale airport projects, it may limit the perspective of junior-level staff. Consequently, the findings represent the insights of seasoned experts rather than a broad cross-section of all professional levels. Furthermore, as 100% of the respondents were directly involved in the construction management of large-scale airport buildings, this criterion was



deemed essential for ensuring the validity and technical accuracy of the assessments provided.

Analysis of External Factors Affecting the Construction Management of Large-Scale Airport Buildings

Based on the analysis of mean values ($\bar{X}$) and their frequency distribution, the significance levels of external factors affecting the Construction Management of Large-Scale Airport Buildings were determined. The following tables present the impact levels based on the previously defined criteria.

Table 1 Impact of External Factors on Work Delays

Item	Impact of External Factors	$\bar{X}$	SD	Results
1	Severe Diseases and Natural Disasters	3.86	1.204	High
2	Legal Regulatory	3.29	0.973	High
Summary	Overall Impact on Work Delays	3.58	0.876	High

Table 1 summarizes the ranking of external factors impacting work delays. Severe Diseases and Natural Disasters ranked first with a high impact ($\bar{X} = 3.86$), followed by Legal Regulatory factors with a moderate impact ($\bar{X} = 3.29$). Overall, external factors affect work delays at a high level ($\bar{X} = 3.58$).

Table 2 Impact of External Factors on Cost Management

Item	Impact of External Factors	$\bar{X}$	SD	Results
1	Severe Diseases and Natural Disasters	3.74	1.168	High
2	Legal Regulatory	3.34	0.934	High
Summary	Overall Impact on Cost Management	3.54	0.912	High

Table 2 summarizes the ranking regarding cost management. Severe Diseases and Natural Disasters ranked first ($\bar{X} = 3.74$), followed by Legal Regulatory factors ($\bar{X} = 3.34$),



both interpreted according to the study's criteria. Overall, the combined impact on cost management is at a high level ($\bar{X} = 3.54$).

Table 3 Impact of External Factors on Work Quality

Item	Impact of External Factors	$\bar{X}$	<i>SD</i>	Results
1	Severe Diseases and Natural Disasters	2.95	1.386	Moderate
2	Legal Regulatory	2.89	1.001	Moderate
Summary	Overall Impact on Work Quality	2.92	1.014	Moderate

Table 3 summarizes the ranking regarding work quality. Both Severe Diseases and Natural Disasters ($\bar{X} = 2.95$) and Legal Regulatory factors ($\bar{X} = 2.89$) are categorized as having a moderate impact. Overall, the impact on work quality is at a moderate level ($\bar{X} = 2.92$).

Results of One-Way Analysis of Variance (One-Way Anova: F-test)

Based on the analysis of survey data regarding opinions on external factors affecting Construction Management of Large – Scale Airport Buildings specifically focusing on Work Delays, Cost Management, and Work Quality data collected from a sample population of 73 respondents. The survey data were subsequently subjected to a One-Way Analysis of Variance (One-Way ANOVA: F-test) to evaluate both the impact levels and frequency levels across each dimension. A summary of these findings is presented in Table 4 as follows:



Table 4 External Factors Affecting Construction Management of Large – Scale Airport Buildings in Terms of Work Delays, Cost Management, and Work Quality, Classified by Educational Background, Work Experience, and Project Stakeholder Groups.

Categorized by	Impact of Construction Management of Large Scale Airport Buildings		
	Work Delays	Cost Management	Work Quality
Education Background			
Severe Diseases and Natural Disasters	Sig = 0.014* Diff	Sig = 0.022* Diff	Sig = 0.213 No Diff
Legal Regulatory	Sig = 0.204 No Diff	Sig = 0.106 No Diff	Sig = 0.193 No Diff
External Factors	Sig = 0.016 No Diff	Sig = 0.024* Diff	Sig = 0.155 No Diff
Summary	Diff	Diff	Diff
Work Experience			
Severe Diseases and Natural Disasters	Sig = 0.869 No Diff	Sig = 0.236 No Diff	Sig = 0.245 No Diff
Legal Regulatory	Sig = 0.869 No Diff	Sig = 0.236 No Diff	Sig = 0.245 No Diff
External Factors	Sig = 0.224 No Diff	Sig = 0.124 No Diff	Sig = 0.162 No Diff
Summary	Diff	Diff	Diff
Project Stakeholder Groups			
Severe Diseases and Natural Disasters	Sig = 0.490 No Diff	Sig = 0.459 No Diff	Sig = 0.207 No Diff
Legal Regulatory	Sig = 0.536 No Diff	Sig = 0.726 No Diff	Sig = 0.202 No Diff
External Factors	Sig = 0.387 No Diff	Sig = 0.495 No Diff	Sig = 0.109 No Diff
Summary	Diff	Diff	Diff

* Statistical Significance Level (Sig.) 0.05



Based on the ANOVA results in Table 4, it was found that educational background significantly influenced the perceived impact of 'Severe Diseases and Natural Disasters' on work delays ($p=0.014$) and cost management ($p=0.022$). Consequently, the null hypothesis was rejected for these specific factors. However, for most other variables, including the stakeholder groups and work experience, the analysis yielded $p > 0.05$, indicating that the null hypothesis failed to be rejected. It is recommended to re-examine the raw data for 'Work Experience' to ensure the accuracy of the reported significance values, as the identical values across factors may suggest an unintended reporting error.

Correlation Analysis Results

Based on the analysis of survey data regarding opinions on external factors affecting Construction Management of Large – Scale Airport Buildings, significant correlations were found among work delays, cost management, and work quality. Utilizing data collected from a sample population of 73 respondents, a Correlation Analysis was subsequently conducted. The results of this analysis are summarized in Tables 5 – 8 as follows:

Table 5 Correlation between External Factors affecting Construction Management of Large – Scale Airport Buildings in Terms of Work Delays and Cost Management

External Factors affecting Work Delay	External Factors affecting Cost Management		
	Severe Diseases and Natural Disasters	Legal Regulatory	Summary of External Factors impacting Cost Management
Severe Diseases and Natural Disasters	$R=.929^{**}$ Sig 0.000 r	$R=.406^{**}$ Sig 0.000 r	$R=.803^{**}$ Sig 0.000 r
Legal Regulatory	$R=.400^{**}$ Sig 0.000 r	$R=.805^{**}$ Sig 0.000 r	$R=.669^{**}$ Sig 0.000 r
Summary of External Factors Impacting Work Delays	$R=.860^{**}$ Sig 0.000 r	$R=.726^{**}$ Sig 0.000 r	$R=.924^{**}$ Sig 0.000 r

* Statistical Significance Level 0.05 ** Statistical Significance Level 0.01

**Table 6** Correlation between External Factors affecting Construction Management of Large – Scale Airport Buildings in Terms of Work Delays and Work Quality

External Factors affecting Work Delay	External Factors affecting Work Quality		
	Severe Diseases and Natural Disasters	Legal Regulatory	Summary of External Factors affecting Work Quality
Severe Diseases and Natural Disasters	R=.676** Sig 0.000 <i>r</i>	R=.273** Sig 0.000 <i>r</i>	R=.597** Sig 0.000 <i>r</i>
Legal Regulatory	R=.393** Sig 0.000 <i>r</i>	R=.673** Sig 0.000 <i>r</i>	R=.600** Sig 0.000 <i>r</i>
Summary of External Factors Impacting Work Delays	R=.683** Sig 0.000 <i>r</i>	R=.561** Sig 0.000 <i>r</i>	R=.744** Sig 0.000 <i>r</i>

* Statistical Significance Level 0.05 ** Statistical Significance Level 0.01

Table 7 Correlation between External Factors affecting Construction Management of Large Scale Airport Buildings in Terms of Cost Management and Work Quality

External Factors affecting Cost Management	External Factors affecting Work Quality		
	Severe Diseases and Natural Disasters	Legal Regulatory	Summary of External Factors affecting Work Quality
Severe Diseases and Natural Disasters	R=.695** Sig 0.000 <i>r</i>	R=.299** Sig 0.000 <i>r</i>	R=.622** Sig 0.000 <i>r</i>
Legal Regulatory	R=.397** Sig 0.000 <i>r</i>	R=.823** Sig 0.000 <i>r</i>	R=.677** Sig 0.000 <i>r</i>
Summary of the external factors' impact on cost management	R=.649** Sig 0.000 <i>r</i>	R=.613** Sig 0.000 <i>r</i>	R=.746** Sig 0.000 <i>r</i>

* Statistical Significance Level 0.05 ** Statistical Significance Level 0.01



Table 8 Correlation between External Factors affecting Construction Management of Large – Scale Airport Buildings in Terms of Work Delays, Cost Management and Work Quality

External Factors affecting Project Management	External Factors affecting Project Management		
	Work Delays	Cost Management	Work Quality
Work Delays	1	.924** Sig 0.000 <i>r</i>	.744** Sig 0.000 <i>r</i>
Cost Management	.924** Sig 0.000 <i>r</i>	1	.746** Sig 0.000 <i>r</i>
Work Quality	.744** Sig 0.000 <i>r</i>	.746** Sig 0.000 <i>r</i>	1

* Statistical Significance Level 0.05 ** Statistical Significance Level 0.01

The correlation analysis revealed significant relationships between the three management dimensions, as detailed in Tables 5 through 8. Notably, a very strong correlation was observed between work delays and cost management ($r = 0.924$, $p < 0.01$). While this confirms a robust link between schedule and budget performance, the magnitude of this coefficient ($r > 0.90$) as shown in Table 8 may suggest that these two dimensions overlap conceptually or operationally in the context of large-scale airport projects. This implies that in practice, external disruptions affecting the construction schedule almost inevitably result in proportional cost escalations.

Furthermore, correlations between work delays and work quality ($r = 0.744$, $p < 0.01$) and cost management and work quality ($r = 0.746$, $p < 0.01$) were also high, as indicated in Tables 6 and 7, indicating that external factors exert a systemic influence on the overall project performance.

Conclusion

The findings of this study provide critical insights into the management of large-scale airport projects, revealing that external factors specifically severe diseases, natural



disasters, and legal/regulatory requirements exert a significant impact on project performance.

The high impact of "Severe Diseases and Natural Disasters" supports previous research by Worawoot Chetnarong et al. (2024), which noted that external shocks like the COVID-19 pandemic create systemic disruptions that are far more difficult to manage than internal issues. The observed strong correlation between work delays and cost management ($r = 0.924$) indicates that in the specific context of airport construction, schedule overruns are almost inevitably linked to proportional cost escalations, likely due to the high costs associated with maintaining compliance in restricted Air Side areas.

The finding that educational background influences perception regarding severe diseases and natural disasters suggests that professionals with higher academic qualifications may have a more comprehensive understanding of risk mitigation strategies, leading them to perceive these external threats differently than those with practical training alone. This aligns with the theory that advanced project management education provides better tools for analyzing and predicting systemic risks.

New Knowledge and Contributions

This study contributes new knowledge to the field of construction management in three key ways:

1. Context-Specific Empirical Evidence: While previous studies (e.g., Safaa Adnan Mohammed & Afrah Hasan, 2024) have analyzed construction efficiency in other countries, this study provides unique empirical evidence on the "Airport Construction" context in Thailand, where strict safety and regulatory requirements amplify the impact of external shocks.

2. Quantification of the Delay-Cost Link: The identified high correlation ($r = 0.924$) between delays and cost escalations in airport projects serves as a new benchmark for project managers, suggesting that schedule management must be prioritized not just for time efficiency, but as a direct financial risk mitigation strategy.

3. Practical Implications for Management: This research offers a refined understanding of how to manage uncontrollable risks. Project managers should integrate "External Factor Monitoring" into their routine project control practices, rather than treating them as isolated risks. By recognizing that educational background affects how



personnel perceive risks, project leaders can develop more targeted training programs to harmonize the risk assessment capabilities within their project teams.

Remark

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