

EVALUATING RISK FACTORS IN CONSTRUCTION CONTRACT MANAGEMENT FOR WATER AND SEWERAGE PROJECTS IN HO CHI MINH CITY

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Abstract - Amidst rapid urbanization, investing in sewerage systems has gained growing attention from researchers and practitioners seeking sustainable urban development. However, managing risk factors in construction contracts for such projects remains challenging, often causing higher costs and administrative burdens. This study aims to identify and evaluate major risk factors associated with sewerage construction projects in Vietnam and to propose strategies for improving contractual risk management. A questionnaire survey was conducted with 80 practitioners from water and sewerage companies in Ho Chi Minh City, and statistical analyses were applied to assess their perceptions. The results indicate that delays in final settlement, poor control of scope changes, and lack of standardized contract management procedures are the most critical risks. Moreover, significant differences were found among practitioners regarding these factors. The study provides valuable insights into contractual risk management and practical implications for enhancing sustainable project delivery in Vietnam.

Key words - Sewerage projects; risk factors; contractual management; survey

1. Introduction

Effective management of sewerage infrastructure has become an increasingly important concern amid the challenges derived from rapid urbanization in developing countries. However, managing construction contracts in water utilities projects is constrained by their inherent characteristics, including the requirement for substantial capital investment and stringent oversight throughout project phases to prevent deviations in cost estimates [1]. When these risks are not sufficiently anticipated and managed, they often result in unexpected cost overruns, schedule delays, and compromised technical quality; thereby undermining public trust and long-term service sustainability [2]. For instance, a statistic by Love, Ahiaga-Dagbui [3] highlighted that approximately 60% water infrastructure projects in the United Kingdom experienced cost overruns, with an average cost overrun of 19.97 % compared to the final approved budget. Thus, determining and evaluating risks associated with sewerage construction projects is essential to improve contractual practices, ensure project productivity, and support sustainable infrastructure development.

Despite numerous studies documenting and examining the risk factors associated with contractual management in infrastructure development across various countries, research evaluating these factors in sewerage projects

remains relatively scarce. Julca-Varas, García-Segura [1] emphasized that inadequate identification and management of such risks often lead to contractual disputes, claims, and litigation, which can disrupt project continuity and inflate overall costs. In addition, insufficient risk knowledge can result in poor allocation of responsibilities between clients and contractors, thereby intensifying conflicts during project execution [4]. These challenges hinder both prompt project delivery as well as the deterioration of infrastructure operations. Moreover, unresolved risks may undermine stakeholder confidence and discourage long-term investment in essential urban sewerage infrastructure. Especially, this issue is essential in the context of Vietnam, where frequent flooding and aging urban drainage systems heighten the demand for effective and resilient sewerage contract administration to ensure sustainable urban development.

Moreover, examining stakeholder perspectives is essential when evaluating risk factors in contractual management for sewerage infrastructure projects. As Zhao et al. noted, individuals' risk perceptions vary according to their roles, backgrounds, and levels of experience in construction and infrastructure domains. Thus, excluding perspectives between involved stakeholders may obscure differences in perceived risk severity and priority, thereby leading to suboptimal strategies. Given the cumbersome coordination processes often encountered in Vietnam's sewerage projects, investigating these nuanced differences facilitates the development of targeted training, communication, and contractual strategies that align with stakeholder maturity. This, in turn, enhances coordination, minimizes conflicts, and strengthens overall project resilience.

Hence, this research aims to determine and examine risk factors in contractual management for sewerage projects in Vietnam. The research questions in this study are as follows:

- What are the risk factors influencing contractual management in sewerage projects?
- What are the different perspectives that stakeholders perceive these risk factors?

To address these research questions, this study adopted a quantitative empirical approach supported by statistical analyses to examine the perceptions of construction stakeholders engaged in water and sewerage projects in Ho

Chi Minh City (HCMC). HCMC was selected as the empirical context due to its status as one of Asia's major megacities, characterized by a high concentration of sewerage infrastructure investments and complex institutional and contractual arrangements. Accordingly, the findings contribute to a more contextualized understanding of contractual risk governance in urban sewerage construction projects and offer practical implications for strengthening project management practices in rapidly urbanizing megacities in Vietnam.

2. Literature review

2.1. Contractual management in sewerage projects

Conceptually, a construction contract is a distinct form of civil agreement established in writing between the employer and the contractor, in which the contractor may be an independent entity or a consortium of firms [5, 6]. According to the terms of the agreement, the contractor is responsible for executing all or part of the construction investment project and delivering the completed works in accordance with the specified quality, schedule, and technical requirements. In return, the employer is obligated to provide relevant documents, technical data, construction sites, and financial resources, as well as to coordinate inspection, acceptance, and payment in compliance with the contractual provisions [7]. Thus, the construction contract serves not only as a legal instrument defining the rights and obligations of each party but also as a managerial mechanism that governs project execution and risk distribution throughout the project life cycle.

In water supply and drainage projects, construction contracts serve as core legal and management instruments that govern relationships among project participants, including clients, contractors, supervision consultants, and regulatory authorities. These projects are characterized by extended construction periods, complex technical scopes, and high dependence on natural conditions such as geology, hydrology, and climate. Such factors heighten uncertainty during implementation, rendering contract management more challenging than in other project types [3, 4]. Furthermore, these projects often involve multiple funding sources, including state budgets, official development assistance (ODA) loans, and public-private partnerships (PPP), which necessitate adherence to diverse legal frameworks, technical standards, and financial mechanisms [8]. Accordingly, contract provisions must be sufficiently flexible to accommodate these variations while maintaining accountability, equitable risk allocation, and effective control throughout the project life cycle [9, 10]. A distinctive feature of contracts in this sector is their interdisciplinary nature, as project implementation typically integrates multiple systems such as water supply, drainage, wastewater treatment, and environmental management. Ineffective coordination among stakeholders at different stages can lead to schedule delays, cost overruns, and contractual disputes. Therefore, examining risk factors in contract management holds both theoretical and practical value, contributing to enhanced project management capability and the long-term sustainability of urban infrastructure development.

2.2. Sewerage contractual management in Vietnam

In Vietnam, studies on construction contract management risks remain fragmented, often project-specific or sector-agnostic, and lack synthesis at the provincial or national level, particularly for sewerage infrastructure. Prior studies have identified persistent deficiencies in contractual clarity and enforcement. For instance, Vo, Nguyen [11] emphasized that contractual provisions related to construction quality control and the handling of unforeseen design changes remain insufficiently defined in many project contracts. This ambiguity, thus, poses difficulties for project owners in responding to on-site incidents and weakens the legal protection of all parties involved. In addition, the absence of detailed schedule appendices for specific work items in several water supply projects creates challenges in updating and adjusting project timelines, as no formal mechanisms or procedures are established to address schedule delays [12]. Furthermore, contractual risks are exacerbated by the lack of specialized contract management units within almost all water utility companies. This leads to responsibilities for monitoring, supervision, information updates, and issue resolution being often assigned to site engineers as additional duties, resulting in limited specialization and inconsistent management practices [13]. Against this backdrop, a systematic identification and evaluation of contractual risk factors in Vietnam's sewerage projects, particularly in megacities such as HCMC, where project scale and institutional complexity are heightened, is both timely and necessary. The insights can contribute to strengthening contract governance mechanisms and informing broader discussions on sustainable infrastructure delivery and contract management reform in Vietnam and comparable developing urban contexts.

2.3. Influencing risk factors in sewerage contractual management

A growing body of research has investigated the risk factors affecting the performance and governance of water supply and sewerage infrastructure projects. Based on the extant literature, this research employed a structured identification process to determine contractual risk factors relevant to Vietnam. This process comprised three stages: (1) a comprehensive review of the literature on infrastructure contract management; (2) systematic screening against Vietnam's construction legal and regulatory framework, including provisions governing contract administration and payment procedures; and (3) validation through expert interviews to ensure contextual appropriateness and practical relevance. Through this multi-stage refinement process, ten risk factors were identified as most pertinent to Vietnam's institutional and regulatory environment. As presented in Table 1, these factors are classified into three interrelated categories: (1) process- and system-related risks, (2) administrative and capacity-related risks, and (3) technical control and enforcement risks.

Process - and system-related risks pertain to deficiencies in contract management procedures, documentation standards, and supporting information systems. These processes form the foundation of transparency,

accountability, and effective decision-making throughout the project life cycle. However, in many Vietnamese water utility enterprises, contract management practices remain highly fragmented due to the absence of standardized procedures and modern digital systems for tracking progress, costs, and variations [14, 15]. Previous studies [16, 17] have noted that contract administration often relies on manual documentation and ad hoc communication, increasing the risk of data inconsistencies and administrative errors. The lack of coordination and information-sharing among stakeholders, particularly between project owners, consultants, and contractors, further constrains timely responses to emerging issues. This limited data integration contributes to reactive rather than proactive risk management, leading to delays, duplicated efforts, and weakened managerial oversight [2, 12].

Administrative and capacity-related risks primarily stem from human and organizational limitations within contract

management functions. Many project management units and water utilities in Vietnam do not maintain specialized contract management departments; instead, contractual responsibilities are assigned to engineers or project officers as secondary tasks. This practice often results in inadequate attention to legal details, contract drafting, and compliance monitoring [3, 18]. Moreover, limited knowledge of contractual law and risk-sharing mechanisms leads to ambiguities in terms and conditions, creating opportunities for disputes and claims. Complex administrative procedures for approval, payment, and final settlement also prolong cash flow cycles and negatively affect contractors' financial stability [13, 19]. Such inefficiencies contribute to cost overruns, reduced productivity, and poor project morale. Additionally, the inequitable distribution of risks between owners and contractors, often due to limited negotiation capacity, exacerbates tensions and reduces trust among stakeholders [20, 21].

Table 1. Summarization of risk factors in sewerage contractual management

Risk category	Code	Risk factors	Explanation	Ref.
Procedural and systemic	B1	Lack of standardized contract management procedures	Lack of unified guidelines for contract administration causes difficulties in monitoring, reporting, and controlling changes	[16, 17]
	B2	Lack of digital systems or contract management software	Contract data are still recorded manually, leading to errors, delays, and limited transparency in documentation.	[14, 15]
	B3	Poor information sharing among stakeholders	Weak coordination between clients, consultants, and contractors reduces decision-making efficiency and increases administrative delays.	[20]
	B4	Insufficient data for monitoring actual progress and quantities	Project progress and quantity data are not systematically updated, causing delays in decision-making and inaccurate performance tracking.	[2, 12]
Administrative and capacity	B5	Limited drafting and legal competence	Contract officers often lack legal and contractual training, resulting in ambiguous or inconsistent contractual provisions.	[3, 18]
	B6	Delays in approval, payment, and final settlement	Complex approval and payment processes with multiple administrative layers disrupt cash flow and project progress.	[13, 19]
	B7	Absence of specialized contract management departments	Contract administration is typically handled by site engineers or technical teams as additional duties, leading to a lack of specialization.	[20, 21]
	B8	Inadequate capacity for risk assessment and allocation	Stakeholders rarely apply systematic risk assessment methods, resulting in unfair or inefficient risk distribution between project parties.	[22]
Technical and enforcement	B9	Poor control of scope changes and cost adjustments	Additional works beyond the original design are not verified or approved on time, causing cost overrun and disputes.	[1, 20]
	B10	Lack of clear mechanisms for dispute resolution and incentive	Contracts often lack explicit clauses on penalties, compensation, or performance incentives, increasing conflicts.	[12]

Technical control and enforcement risks concern weaknesses in overseeing technical quantities, cost adjustments, and compliance during contract execution. In sewerage projects, variations in design and site conditions are common; however, the absence of formal procedures for managing design modifications and verifying additional works frequently leads to cost escalation and schedule slippage [1, 16]. The problem is compounded by the limited use of independent verification and performance auditing mechanisms, which diminishes accountability and transparency. Moreover, many sewerage contracts lack explicit provisions for non-performance penalties, performance-based incentives, or dispute resolution pathways, resulting in ambiguous enforcement and prolonged conflict resolution [7, 12]. These contractual deficiencies not only weaken the governance and motivation of contractors but also reduce overall project resilience and sustainability.

In summary, effective management of contractual risks in sewerage infrastructure requires addressing procedural weaknesses, enhancing institutional capacity, and strengthening enforcement mechanisms. Standardizing contract administration procedures, developing specialized human resources, and integrating digital contract management systems would significantly improve coordination and control. Addressing these interrelated risk dimensions holistically can enable Vietnamese sewerage agencies to enhance contractual performance, mitigate disputes, and promote long-term sustainability in urban water infrastructure development.

3. Research methods

3.1. Questionnaire development

Based on these identified risk factors, a questionnaire was designed in this study to collect data on risk factors influencing contractual management in sewerage

infrastructure projects in Vietnam. The questionnaire includes two main sections. The first section collected demographic information of respondents, including their organization type, position, and years of professional experience. The second section focused on assessing ten identified categorized risk factors. Respondents were asked to rate the significance level of each risk factor using a five-point Likert scale (where 1 = very low significance and 5 = very high significance). This measurement approach has been widely adopted in construction risk management studies for its ability to capture respondents' subjective perceptions quantitatively [23]. Prior to the main survey, the questionnaire was pre-tested with five experts in construction contract management to ensure clarity, relevance, and content validity. Feedback from the pilot test was incorporated to refine question wording and improve overall comprehensibility before large-scale distribution.

3.2. Data collection

Then, the questionnaire was distributed to professionals involved in sewerage and water infrastructure projects in Vietnam. The target population comprised practitioners from public water supply and drainage agencies, project management units, and private construction contractors who were directly involved in water supply, drainage, or sewerage construction projects in HCMC. A snowball sampling approach was adopted to ensure that participants possessed substantial experience in contract management or project administration within the water sector. This approach is consistent with previous studies in construction management that emphasize the importance of respondent expertise to ensure data reliability and contextual relevance [4].

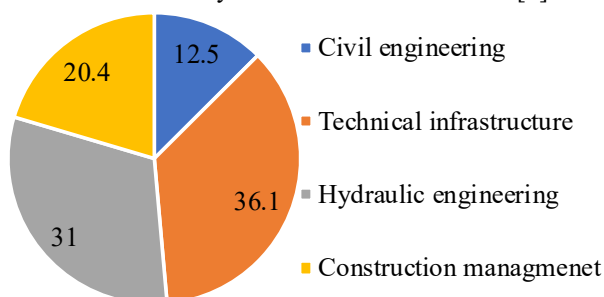


Figure 1. Respondent's professional

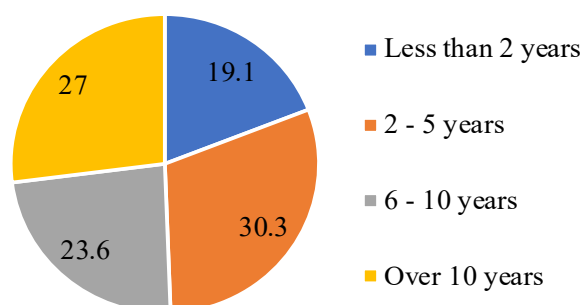


Figure 2. Respondents' experiences

Around 210 distributed questionnaires, 80 valid responses were received, representing a response rate of approximately 38%, which is considered adequate for statistical analysis in exploratory studies [11]. Respondents included project managers, contract administrators, site

engineers, and consultants, with professional experience ranging from less than 5 years to more than 10 years. This diversity allowed the study to compare perceptions of contractual risk factors across different stakeholder groups and experience levels, thereby strengthening the interdisciplinary nature of sewerage projects and enabling examination of role-based differences in contractual risk perception. Figures 1 and 2 present the professional information of respondents in this study.

3.3. Statistical analysis

The collected data were analyzed using both descriptive and inferential statistical techniques to evaluate the significance and variability of risk factors associated with contractual management in sewerage projects. Prior to conducting inferential tests, the normality of the data distribution was examined using the Shapiro–Wilk test, which is recommended for small to medium sample sizes ($n < 50$) to assess whether the dataset deviates significantly from a normal distribution [24]. The results indicated that the majority of the data did not follow a normal distribution ($p < 0.05$), justifying the use of non-parametric statistical methods for subsequent analyses.

Then, the mean rank values were calculated to describe the relative importance of each risk factor as perceived by respondents. This ranking technique provides a practical means of prioritizing contractual risk factors when the underlying data are ordinal in nature, as derived from the five-point Likert scale. Subsequently, the Kruskal–Wallis H test was employed to determine whether statistically significant differences existed among stakeholder groups with varying years of professional experience. This non-parametric alternative to one-way ANOVA was selected due to its robustness in handling ordinal data and non-normal distributions [25]. All analyses were conducted using IBM SPSS Statistics 20, and results were interpreted at a 95% confidence level ($\alpha = 0.05$).

The combination of these analytical methods ensured that both the tendencies and inter-group variations in perceived contractual risks were rigorously examined, providing empirical insights into how experience levels influence risk perception and prioritization within Vietnam's sewerage construction industry.

4. Results and discussions

4.1. Principal risk factors to sewerage contractual management

The results presented in Table 2 reveal that the most influential risk factors affecting sewerage contract management in Vietnam are B6 (Delays in approval, payment, and final settlement), B9 (Poor control of scope changes and cost adjustments), and B1 (Lack of standardized contract management procedures), with mean values of 4.201, 4.181, and 4.101, respectively. These findings indicate that procedural inefficiencies and administrative delays continue to be the predominant challenges constraining project performance and governance in the sewerage sector. Ineffective payment approval mechanisms and prolonged settlement processes not only disrupt cash flow but also diminish contractor

motivation and project continuity. Similarly, weak control over design variations and cost adjustments often results in budget deviations, time overruns, and disputes between contracting parties.

Table 2. Influence level of risk factors

Barriers	Min - Max	Std statistic	Mean value
B1	1 - 5	1.046	4.101
B2	1 - 5	1.058	4.050
B3	1 - 5	1.018	3.970
B4	1 - 5	1.013	3.881
B5	1 - 5	0.998	3.751
B6	1 - 5	1.058	4.201
B7	1 - 5	1.019	3.910
B8	1 - 5	1.021	3.812
B9	1 - 5	1.011	4.181
B10	1 - 5	1.005	4.070

These findings are consistent with previous research by Love, Ahiaga-Dagbui [3], which identified bureaucratic approval procedures and uncontrolled design changes as causes of cost escalation in water infrastructure projects. Zou, Zhang [4] likewise emphasized that the absence of standardized contract procedures significantly increases the likelihood of contractual disputes and schedule delays. The relatively high mean values observed for B10 (Lack of clear mechanisms for dispute resolution and incentives) and B2 (Lack of digital systems or contract management software) reinforce earlier findings by Julca-Varas, García-Segura [1], suggesting that inadequate governance frameworks and limited digitalization hinder transparency, traceability, and accountability in contractual practices.

Overall, these results highlight the urgent need for Vietnamese sewerage authorities to implement standardized, technology-enabled contract management frameworks, supported by transparent dispute resolution mechanisms, to enhance project efficiency, financial discipline, and long-term sustainability in urban water infrastructure delivery.

4.2. Stakeholder perspectives on risk factors in sewerage contractual management

Table 3. Stakeholders' perspectives on risk factors

Barriers	Group of stakeholders				KW
	CV	TI	HE	CM	
B1	4.351	4.101	3.784	4.421	0.002*
B2	3.962	4.052	3.895	4.106	0.595
B3	4.283	4.119	3.772	4.368	0.012*
B4	3.829	3.902	3.957	3.879	0.911
B5	3.756	3.861	3.689	3.802	0.410
B6	4.187	4.256	4.111	4.204	0.601
B7	3.928	4.001	3.855	3.956	0.509
B8	3.881	3.955	3.760	3.827	0.120
B9	4.223	4.305	4.150	4.261	0.291
B10	4.401	4.151	3.821	4.455	0.008

Notes: CV denotes civil engineering, TI denotes technical infrastructure, HE denotes hydraulic engineering, and CM denotes construction management. Wherein, * denotes that there exists a significant difference between groups at the 0.05 significant level.

The results in Table 3 indicate meaningful heterogeneity in stakeholders' perceptions of contractual risk factors across professional groups. Significant differences were detected for B1 (lack of standardized contract management procedures), B3 (poor information sharing among stakeholders), and B10 (absence of clear dispute-resolution and incentive mechanisms) based on the Kruskal–Wallis tests ($p < 0.05$). These patterns suggest that professional background and role exposure shape how respondents evaluate procedural and governance-oriented risks. Notably, construction management (CM) professionals consistently assigned higher ratings to B1, B3, and B10 relative to civil engineering (CV), technical infrastructure (TI), and hydraulic engineering (HE) groups, reflecting CM's direct responsibility for contract administration, coordination, and claims handling. This is consistent with prior studies showing that unclear procedures and weak communication architectures elevate the likelihood of disputes, cost growth, and delay in infrastructure delivery [1, 3]. By contrast, TI and HE respondents tended to rate administrative/procedural risks lower, plausibly because their day-to-day focus centers on technical design and field execution rather than contractual governance. Similar divergence between managerial and technical cohorts has been reported elsewhere, where managerial staff perceive comparatively higher contractual and coordination risks than technical personnel [26]. Collectively, these findings underscore the need for standardized contract administration frameworks (e.g., SOPs aligned with FIDIC/owner procedures), formal communication protocols (RACI matrices, transmittal workflows, and common data environments), and early dispute-avoidance mechanisms (dispute boards and performance-linked incentives). Such measures can harmonize risk perceptions across disciplines, improve accountability and transparency, and ultimately reduce conflict and rework in Vietnam's sewerage construction projects [27, 28].

4.3. Practical applications

Based on the research findings, the results of this study have significant practical implications for improving contractual management practices in Vietnam's sewerage infrastructure projects. The consistently high ratings of risks such as delays in approval and payment (B6), poor control of scope changes and cost adjustments (B9), and lack of standardized contract management procedures (B1) reflect persistent weaknesses in the governance and administrative systems of public utilities. These challenges reveal a need for structural reforms to strengthen transparency, accountability, and efficiency in contract management processes. The discussion presented in this section pertains to applications in construction-phase contracts, as this stage constitutes the most administratively intensive and dispute-sensitive phase of sewerage infrastructure delivery. Accordingly, the practical recommendations derived from this study are intended to inform improvements in construction-stage contractual management.

First, the establishment of a standardized contract management framework is crucial. Currently, contract administration practices vary widely across provinces and

project management units, leading to inconsistencies in documentation, reporting, and dispute resolution. Developing a national guideline aligned with international standards such as those proposed by FIDIC would help unify contract terms, risk allocation procedures, and performance monitoring mechanisms. Such standardization would not only streamline administrative approvals but also provide a clear legal basis for addressing contractual changes, payment delays, and quality deviations, thereby reducing disputes and improving compliance.

Second, the study highlights the urgent need to digitalize contract administration systems within the sewerage and water infrastructure sector. As identified in previous research by Love, Ahiaga-Dagbui [3] and Julca-Varas, García-Segura [1], the reliance on manual documentation and fragmented data flows often results in miscommunication, information loss, and inefficient decision-making. Implementing integrated digital platforms such as Building Information Modeling (BIM) for contract and progress management or web-based Project Information Management Systems (PIMS) can enable real-time monitoring of contractual milestones, payments, and variations. This transition would also facilitate transparent auditing, improve coordination among contractors and consultants, and ensure better traceability of project documentation.

Third, the findings underscore the importance of capacity building and professional training. Many water utilities and project management units still lack specialized contract management departments; instead, engineers or technical staff handle contractual issues as secondary duties. This arrangement often leads to limited understanding of legal clauses, risk-sharing principles, and dispute resolution procedures. Regular training programs, possibly integrated into continuing professional development (CPD) frameworks, should be designed to enhance practitioners' legal, financial, and negotiation skills. Collaborative training sessions involving contractors, consultants, and government officials can also help align expectations and strengthen the culture of joint risk management.

Fourth, improving risk allocation and incentive mechanisms is vital. Contracts in Vietnam's sewerage projects often emphasize compliance rather than performance, with limited flexibility to accommodate uncertainties such as changes in site conditions or regulatory adjustments. Incorporating performance-based contracting models, including incentives for timely completion and penalties for non-performance, can promote accountability and encourage proactive risk management. In parallel, establishing clear procedures for dispute resolution through mediation or arbitration can prevent escalation and preserve working relationships among stakeholders.

Finally, bridging perceptual differences among stakeholder groups is essential for holistic project governance. The significant variations in risk perception found between construction management professionals and technical engineers suggest that each group approaches

project risks through its disciplinary lens. Creating cross-functional working groups and routine communication platforms can foster shared understanding of contractual priorities and responsibilities. Such collaboration would enhance decision-making coherence and minimize conflicts during project implementation.

In summary, strengthening Vietnam's sewerage contractual management system requires an integrated approach combining regulatory reform, digital transformation, capacity enhancement, and institutional collaboration. The implementation of standardized contract frameworks, supported by digital tools and performance-based governance, will not only mitigate key contractual risks but also contribute to sustainable infrastructure delivery and improved public service efficiency. These insights provide actionable guidance for policymakers, project managers, and practitioners striving to modernize the contractual environment of Vietnam's urban water and sanitation sector.

5. Conclusion

This study identified and evaluated the key risk factors influencing contractual management in sewerage projects in Vietnam. Ten critical risks were classified into three overarching categories: procedural and systemic, administrative and capacity-related, and technical and enforcement risks. The results revealed that procedural inefficiencies, delays in payment approval, and inadequate control of scope changes are the most influential factors undermining contract performance. Furthermore, significant perceptual differences were observed among professional groups, suggesting that practitioners' roles and levels of experience shape their evaluation of contractual risks.

These findings emphasize the necessity of establishing standardized contract management frameworks, digitalized monitoring and reporting systems, and cross-disciplinary collaboration within Vietnam's water and sewerage sector. Strengthening risk allocation procedures, clarifying contractual responsibilities, and enhancing dispute resolution mechanisms can collectively mitigate cost overruns, reduce administrative burdens, and improve project governance. In particular, adopting integrated digital platforms for contract tracking and documentation would enhance transparency, coordination, and accountability among stakeholders.

Beyond practical implications, this study contributes to the broader understanding of contractual risk management in developing infrastructure contexts. Nevertheless, several limitations should be acknowledged. First, the survey sample was confined to HCMC and therefore, may not fully capture regional variations in contractual practices, institutional capacity, and regulatory enforcement across different provinces in Vietnam. Second, the scope of the analysis focuses primarily on sewerage and drainage construction-phase contracts, without examining water supply projects in detail or extending to operation and maintenance contract arrangements, which may involve distinct risk allocation mechanisms.

Future research should expand the geographical scope to include multiple provinces and conduct comparative analyses to assess regional differences in contractual governance. In addition, later studies may explore distinctions between construction and operation contracts, as well as between sewerage and water supply systems, to provide a more comprehensive understanding of sector-specific contractual risks. By doing so, future research could enable more adaptive and resilient contract management practices in Vietnam's urban infrastructure development.

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