IDENTIFYING QUALITY MANAGEMENT GAPS IN THE PREPARATION AND MPLEMENTATION OF PUBLIC INVESTMENT PROJECTS: A MULTIPLE-CASE STUDY IN TRA VINH AND VINH LONG PROVINCES

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ABSTRACT:

This study employs the multiple-case study methodology proposed by Robert K. Yin (2014) to conduct an in-depth analysis of three public investment projects in Tra Vinh and Vinh Long provinces, including two road transportation projects (P01 and P02) and one civil construction project (P03). The projects, implemented between 2018 and 2022, had a combined investment value of VND 78.5 billion. The analysis identifies nine systemic gaps (G-1 to G-9) across two independent control layers, which are classified into three thematic categories: deficiencies in mandatory survey content, the absence of field-verification mechanisms during project appraisal, and the lack of flexible financial procedures to address technical changes resulting from administrative decisions. The findings provide empirically grounded evidence supported by specific legal references and contribute to improving the effectiveness of quality control from the project preparation and formulation stages onward.

Keywords: quality management gaps, multiple-case study, preparation, project implementation, root cause analysis, project life cycle.

1. Introduction

Construction quality in localities of the Mekong Delta (MKD) region remains a persistent management challenge. Despite the progressive refinement of the regulatory framework - from Decree 59/2015/ND-CP to Decree 06/2021/ND-CP and Decree 175/2024/ND-CP - many projects continue to exhibit serious defects during construction or experience rapid deterioration following commissioning.

Existing domestic research predominantly adopts a general theoretical framework approach (Chung, 2009), without identifying which specific gaps occur in which particular projects, at which phase, and with what consequences. At the international level, Pinto & Slevin (1987), as well as Chan & Chan (2004),

both emphasize the decisive importance of the preparation phase for output quality.

To address this gap, this study applies the multiple-case study methodology following Yin (2014) to conduct an in-depth analysis of three projects in Tra Vinh, Vinh Long Province. The objective is not to assign individual liability, but to perform a systemic diagnosis: identifying which gaps in the quality management process created the conditions for failures to occur, tracing their origins, and determining the necessary interventions.

2. Theoretical background

In construction project management, a "gap" is defined as the discrepancy between the requirements of the quality management system - as prescribed by law and technical standards - and actual implementation practice at the project level (Love et al., 2000). Gaps typically originate from: the absence of specific procedures, the lack of control instruments, schedule and cost pressures, or limited capacity among implementing stakeholders. The PMBOK Guide (PMI, 2017) identifies quality control from the earliest stages of the project life cycle as the intervention with the lowest prevention cost yet the highest effectiveness - consistent with the argument advanced by Love et al. (2000) that the cost of detecting and rectifying defects increases exponentially across successive project phases.

Root Cause Analysis (RCA) and the "5 Whys" method are employed to trace observed phenomena back to systemic root causes (Ohno, 1988), with the aim of identifying the structural conditions that allow errors to occur and recur - rather than arriving at superficial conclusions such as "contractor error."

The Swiss Cheese model (Reason, 2000) is referenced to explain the underlying mechanism: failures in construction rarely result from a single cause, but are instead the product of multiple gaps simultaneously present across multiple control layers - design, appraisal, supervision, and construction. A failure occurs when gaps across multiple layers align, allowing risk to penetrate the entire protective system.

3. Research methodology

This study employs the multiple-case study methodology following Yin (2014), analysing three projects with the objective of identifying recurring gap patterns (replication logic) rather than isolated outcomes from a single project. The three projects were selected to represent the two principal construction categories in Tra Vinh, Vinh Long Province: road transport (P01, P02) and civil construction (P03). Selection criteria included: (i) documented anomalies recorded in actual project files; (ii) coverage of diverse problematic phases across the project life cycle; and (iii) availability of sufficient documentation for in-depth analysis (Table 1).

Data were collected in 2022 from two primary sources. Secondary data comprised the legal and technical documentation of each project: Economic and Technical Appraisal Reports (ETARs), feasibility study reports, construction drawing designs, quantity take-off schedules, acceptance records, and approved adjustment decisions for cost variations. Primary data were collected through in-depth interviews with 20 experts (72.5% in the transport sector; 27.5% in civil construction), representing four stakeholder groups: the Owner (OW), the Project Management Unit (PMU), the Supervision Consultant (SC), and the construction contractor.

Data analysis comprised three steps: (1) chronological description of events; (2) application of RCA using the "5 Whys" to trace causality to root causes, classified into three levels - implementation failure, process failure, and systemic failure - with cross-verification from at least two independent sources; and (3) cross-case comparison across the three projects to identify recurring gap patterns.

4. Case analysis

4.1. Project P01 - Upgrading of Provincial Road 7, Binh Phu Commune

4.1.1. Sequence of Events and Anomalies

During the review of actual construction quantities - at approximately 63% of contract value - the parties identified serious discrepancies in the

Table 1. Overview of the Three Analyzed Projects

No.	Criterion	P01	P02	P03
1	Project name	Upgrading and widening of Provincial Road 7, Km12+900-Km19+300, Binh Phu Commune	Tam Ngai – Thong Hoa Inter-Commune Road, Tam Ngai Commune	Archive building for land cadastral records and working space for Branch Land Registration Offices (LROs) in districts, towns, and Tra Vinh City
2	Construction type	Transport (road & bridge)	Transport (road & bridge)	Civil (office building)
3	Location	Binh Phu Commune, Vinh Long Province	Tam Ngai Commune, Vinh Long Province	9 districts/towns and Tra Vinh City (old)
4	Owner	Tra Vinh Provincial Department of Transport	Tra Vinh Provincial Department of Transport	Tra Vinh Provincial PMU for Civil and Industrial Construction
5	Scale	L = 5,334.58 m (road: 5,250.38 m; bridge: 84.2 m)	L = 3,124.46 m; 6 permanent RC bridges; rural road, Grade B	9 two-storey buildings; floor area 210–398 m²/building
6	Total investment	VND 40.0 billion	VND 15.0 billion	VND 23.5 billion
7	Implementation period	2018–2020	2018–2020	2021–2022
8	Construction grade	Transport Grade IV	Transport Grade IV	Civil Grade III
9	Applicable legal framework	Decree 59/2015/ND-CP; Construction Law 2014 (Law No. 50/2014/QH13)	Decree 59/2015/ND-CP; Construction Law 2014 (Law No. 50/2014/QH13)	Preparation phase: Decree 59/2015/ND-CP; Construction Law 2014. Implementation phase: Decree 06/2021/ND-CP; Construction Law 2014 (amended 2020)

Source: Compiled by the authors from project documentation

project documentation: certain work items were represented in detail on the construction drawings but were entirely absent from the bill of quantities; simultaneously, quantity errors - both under-measurement and over-measurement - were detected across multiple other items.

The joint review record states: "the Design Consultant (DC) exhibited deficiencies and failed to ensure documentation quality, necessitating the processing of cost variations (increases/decreases); furthermore, the unit responsible for appraising the construction drawing design and cost estimate was insufficiently rigorous in reviewing and controlling quantities."

4.1.2. Root Cause Analysis and Systemic Gaps

The failure in P01 originated from two entirely independent chains of gaps, operating in parallel across two distinct control layers.

- Line A - Documentation production layer: existing regulations clearly prescribe the DC's comprehensive responsibility for documentation quality (Article 22, Decree 59/2015/ND-CP). The DC's failure to cross-check drawings against the bill of quantities prior to issuing the documentation - attributable to limited capacity or schedule pressure - constitutes a failure to fulfil a stipulated obligation, not a regulatory gap.

- Line B - Control layer (appraisal): tracing further raises the question of why this error passed through the entire system undetected. The answer lies in a dual blind spot in the design of the appraisal content: under Article 83, Clause 7 of the Construction Law 2014 and Article 30, Clause 2 of Decree 59/2015/ND-CP, the mandatory appraisal content only requires verification of "principal quantities" - meaning errors in detailed line items fall outside the scope of mandatory control; and there is no trigger criterion for independent verification, nor any minimum checklist of appraisal content. This constitutes systemic Gap G-1: when the control layer contains such a blind spot, even a straightforward implementation failure at the production layer is sufficient to pass through the entire protective barrier undetected - precisely the mechanism described by the Swiss Cheese model (Reason, 2000).

4.2. Project P02 - Tam Ngai - Thong Hoa Inter-Commune Road, Tam Ngai Commune

4.2.1. Sequence of Events and Anomalies

Unlike P01, which involved a single anomalous event, P02 generated three independent events, discovered successively as the contractor conducted field inspections and commenced construction.

Event S1 - Omission of six existing bridges requiring demolition: Upon inspecting the full route alignment, the contractor discovered six existing RC bridges at the exact chainage stations designated for the six new bridges, all currently in use by local residents. Cross-referencing with the approved ETAR revealed no demolition line item for the existing bridges - only a line item for "on-land RC structure demolition using a chisel hammer" with a provisional quantity of 6 m^3 (referring to CC pavement demolition, not bridges).

Event S2 - Absence of traffic safety systems at Km1+603: At the Kenh Suoi 1 bridge intersection, the approach road - approximately 3 m in length - was perpendicular to and coincided with the designed alignment, creating a hazardous conflict point. The ETAR did not provide for any traffic safety system at this location. The parties were required to supplement the design with 40 m of flexible guardrails with retroreflectors.

Event S3 - Insufficient navigational clearance for inland waterway traffic: Ba Trong Bridge and Ba Bac Bridge were designed as "non-navigable" structures. After the superstructure of Ba Trong Bridge and the abutments of Ba Bac Bridge had been constructed, local residents and the People's Committee of Thong Hoa Commune raised concerns that the new clearance height was lower than that of the existing bridges, impeding the waterway transport of agricultural goods. A clearance increase of +0.5 m above the constructed beam soffit elevation was subsequently required.

The project record concludes: "the Design Consultant failed to ensure the quality of topographic survey works, resulting in the need to make adjustments to conform to actual site conditions after construction had already commenced."

4.2.2. Root Cause Analysis and Systemic Gaps

Given the three distinct anomalous events, RCA was conducted separately for each, tracing causality along two independent lines at the documentation production layer (DC) and the control layer (appraisal).

- Event S1 originated from the DC's failure to conduct an inventory survey of existing structures along the alignment. Further tracing reveals the root cause as Gap G-2: no regulation designates "inventory of existing structures along the alignment" as

mandatory survey content for Grade IV transport works documentation. At the control layer, the documentation - lacking this item - passed through appraisal undetected, as the appraisal process included no step to cross-check bill-of-quantities items against site conditions. This constitutes Gap G-3: no regulation requires verification of the completeness of survey documentation against actual site conditions as part of the mandatory appraisal content (Article 30, Clause 2, Decree 59/2015/ND-CP).

- Event S2 exhibits an analogous structure: the DC neither conducted a detailed geometric survey of the intersection nor identified the conflict point, because Gap G-4 - no regulation mandates this as part of road design survey documentation. At the appraisal layer, there was no independent step to verify traffic safety at conflict points, corresponding to Gap G-5: no regulation requires traffic safety verification at conflict points as a distinct component of mandatory appraisal content (Article 30, Clause 2, Decree 59/2015/ND-CP).

- Event S3 similarly exposes a comparable dual blind spot: the DC neither consulted local residents nor the local authority when determining the navigational clearance parameters, due to Gap G-6 - no regulation mandates this consultation step; while at the appraisal layer, the ETAR specifying a "non-navigable" clearance was approved without requiring local authority input, due to Gap G-7: no regulation requires local authority consent regarding inland waterway navigation needs as a mandatory precondition for ETAR approval (Article 30, Clause 2, Decree 59/2015/ND-CP).

4.3. Project P03 - Land Cadastral Records Archive Building for Branch LROs

4.3.1. Sequence of Events and Anomalies

The anomalous events at the Tieu Can District Branch LRO building unfolded across three successive stages: (S1) the end-user unit objected to the initially proposed site as early as the policy proposal report preparation stage; (S2) the Tieu Can District People's Committee required a site relocation to reorganize public land and property assets - geotechnical investigations at the new site revealed significantly weaker subsoil conditions, requiring the DC to change the foundation design from strip footings to pressed-pile foundations, generating additional costs; (S3) the contingency allowance within the approved total investment was insufficient to cover the additional costs, necessitating a total investment adjustment - a process requiring full re-appraisal and re-approval. Faced with this impasse, the contractor proposed to bear the full cost of the foundation design modification in order to maintain the working relationship.

4.3.2. Root Cause Analysis and Systemic Gaps

P03 exhibits a fundamentally different gap structure from P01 and P02. In those two projects, gaps resided in the technical control content and the parties had committed violations or omissions in fulfilling their obligations. In P03, all parties performed their professional responsibilities correctly - the DC re-surveyed the site and adjusted the technical solution to reflect actual site conditions, while the OW duly acknowledged the legitimately arising variations. The gap does not reside in conduct, but in the legal mechanism for handling the financial consequences when technical conditions change as a result of an administrative decision.

- Events S1–S2 trace to Gap G-8: Article 14 of Decree 59/2015/ND-CP prescribes the project adjustment procedure when the construction site is changed, yet contains no provision requiring the reassessment and corresponding adjustment of the total investment to account for the risk of changed geotechnical conditions at the new site as a mandatory step. As a result, the total investment was retained unchanged despite a fundamental shift in actual technical conditions, creating a financial shortfall from the moment the administrative site-change decision was issued.

- Event S3 traces to Gap G-9: Article 17, Clause 3 of Decree 06/2021/ND-CP stipulates that cost variations must receive the approval of either the OW or the investment decision-maker before they may serve as a basis for payment. This means that in order

to obtain payment for variations exceeding the contingency allowance, the full procedure for re-appraisal of the adjusted total investment must be completed. The existing legal framework contains no expedited procedure or mandatory processing timeframe for variations arising from objectively changed technical conditions - that is, variations attributable to no fault of any contracting party.

Viewed in totality, P03 reflects a gap pattern characteristic of civil construction projects where site relocation is effected by administrative decision: the chain of events S1 → S2 → S3 operates as a domino effect, in which Gap G-8 (absence of a mechanism to reassess total investment upon site change) activates the conditions leading to Gap G-9 (absence of a flexible payment procedure for objectively arising variations). The consequence is that the financial burden of an administrative decision is transferred entirely to the contractor - the party bearing no fault and possessing no legal instrument to protect its interests in this circumstance.

4.4. Cross-Case Comparison and Synthesis of Systemic Gaps

The RCA findings from the three projects are systematized into nine gaps (G-1 through G-9), classified by thematic group and independent control layer, as presented in Table 2.

Two analytically significant findings emerge from Table 2. First, none of the nine identified gaps is classifiable as a purely individual error - all are rooted in blind spots within the regulatory system design, consistent with Reason's argument regarding the structural conditions that allow errors to occur and recur (Reason, 2000). Second, Group B exhibits the highest recurrence frequency, with four gaps appearing in both P01 and P02, indicating that the verification mechanism within appraisal constitutes a representative systemic weakness - not an isolated anomaly - in the quality control system during the project preparation phase at the local level.

The most critical finding from the cross-case comparison is not the mere existence of these gaps, but the decisive role of the control layer (Line B). In P01, Line A involved only a straightforward implementation failure - the DC did not cross-check drawings against the bill of quantities, an obligation clearly prescribed by regulation. Nevertheless, the failure passed through the entire protective system because Gap G-1 at Line B created an irreparable blind spot. In P02 and P03, both lines exhibited

Table 2. Classification of Gaps by Thematic Group and Recurrence Frequency

Gap Group	Gap Code	Count	Projects Affected	Remarks
Group A: Gaps in mandatory survey content	G-2, G-4, G-6	3	P02	Concentrated at the documentation production layer; reflects deficiencies in survey content regulations for Grade IV transport works.
Group B: Absence of field-verification and content-control mechanisms in appraisal	G-1, G-3, G-5, G-7	4	P01, P02	Recurring across both transport projects; reflects a systemic blind spot in the design of mandatory appraisal content.
Group C: Absence of flexible financial mechanisms for objectively changed technical conditions	G-8, G-9	2	P03	Specific to civil construction projects with administratively directed site relocation; reflects a gap in total investment adjustment procedures.

Source: Compiled by the authors

systemic gaps - yet even where only an implementation failure existed at Line A, G-1 demonstrates that this alone was sufficient for the failure to go undetected. In other words, a gap at the control layer constitutes a sufficient condition for a failure to pass through the system - regardless of whether Line A involves a systemic gap or merely an isolated implementation failure. This is the most direct policy implication of the study: strengthening the control layer (Group B) will yield the greatest preventive effect, even when capacity at the documentation production layer has not yet been uniformly improved.

5. Discussion

Several limitations of this study warrant acknowledgement. First, the three cases were selected on the criterion of documented anomalies, and are therefore not representative of the province's full project portfolio; accordingly, the frequency of gap occurrence cannot be extrapolated to the population at large. Second, interview data were collected from directly involved parties, with an inherent risk of self-protective bias; although cross-verified against technical documentation, certain information regarding decision-making rationales could not be independently verified in full. Third, the scope of the study is confined to the preparation and project formulation phase; gaps arising purely during construction are outside its remit.

The findings establish a foundation for three directions of future research: (1) large-scale validation through quantitative studies with samples covering multiple MKD provinces, to quantify the recurrence frequency of the nine identified gaps; (2) construction-phase analysis to extend the investigation to gaps forming during site supervision and acceptance inspection; and (3) intervention effectiveness evaluation, following the piloting of the proposed policy recommendations.

6. Conclusion

This study applies the multiple-case study methodology, integrating RCA with the Swiss Cheese model, to conduct an in-depth analysis of three public investment projects in Tra Vinh Province. The results identify nine systemic gaps across two independent control layers and three thematic groups: gaps in mandatory survey content (Group A), absence of field-verification mechanisms in appraisal (Group B), and absence of flexible financial procedures for objectively caused variations (Group C).

The study's core contribution is twofold. Methodologically, this represents one of the first applications combining the RCA "5 Whys" technique with the Swiss Cheese model to analyze quality in public investment projects within the Vietnamese institutional context. Practically, all nine gaps have been traced to specific statutory provisions, providing a direct basis for regulatory authorities to review and supplement existing regulations - rather than limiting recommendations to general calls to "enhance capacity" or "strengthen oversight" ■

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NHẬN DIỆN CÁC LỖ HỔNG TRONG QUẢN LÝ CHẤT LƯỢNG Ở GIAI ĐOẠN CHUẨN BỊ VÀ TRIỂN KHAI CÁC DỰ ÁN ĐẦU TƯ CÔNG: NGHIÊN CỨU ĐA TRƯỜNG HỢP TẠI TỈNH TRÀ VINH VÀ TỈNH VĨNH LONG

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TÓM TẮT:

Nghiên cứu này áp dụng phương pháp nghiên cứu đa trường hợp của Robert K. Yin (2014) để phân tích chuyên sâu 03 dự án đầu tư công tại tỉnh Trà Vinh và tỉnh Vĩnh Long, bao gồm hai dự án giao thông đường bộ (P01 và P02) và một dự án xây dựng dân dụng (P03). Các dự án được triển khai trong giai đoạn 2018 - 2022 với tổng mức đầu tư 78,5 tỷ đồng. Kết quả phân tích đã xác định được 09 lỗ hổng mang tính hệ thống (G-1 đến G-9) trong hai lớp kiểm soát độc lập. Các lỗ hổng này được phân thành 03 nhóm, gồm: thiếu sót trong nội dung khảo sát bắt buộc, sự thiếu vắng cơ chế kiểm chứng thực địa trong quá trình thẩm định, và việc chưa có các thủ tục tài chính linh hoạt để xử lý những thay đổi kỹ thuật phát sinh từ các quyết định hành chính. Các phát hiện của nghiên cứu cung cấp bằng chứng thực nghiệm có đối chiếu với các căn cứ pháp lý cụ thể, qua đó góp phần nâng cao hiệu quả kiểm soát chất lượng ngay từ giai đoạn chuẩn bị và lập dự án đầu tư công.

Từ khóa: các lỗ hổng trong quản lý chất lượng, nghiên cứu trường hợp đa dạng, chuẩn bị, triển khai dự án, phân tích nguyên nhân gốc rễ, vòng đời dự án.