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Design-to-Cost in construction project cost management: A conceptual review and structural limitations

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KEYWORDS

Design-to-Cost
Cost-dominated governance
Construction cost management
Value governance
Value engineering
Target Value Design

ABSTRACT

Cost management has long occupied a central position in construction investment project management, where project success is commonly assessed through budget compliance. Within this context, Design-to-Cost has evolved beyond a cost control tool to become a cost-centred governance logic that shapes design decisions, organisational behaviour, and prevailing interpretations of project value. This paper adopts a conceptual and critical literature review to reframe this approach as a form of governance, elucidating the implicit assumptions that underpin it and the ways in which these assumptions are institutionalised into structural limitations in project practice. The paper also clarifies related constructs (target costing; designing to target cost) and conceptualises cost-based design steering as a mediating mechanism linking budget constraints to design decision-making. In doing so, the study reveals a core contradiction: effective cost management does not necessarily translate into effective value governance. The paper thus establishes a theoretical foundation for subsequent research on value-based design and delivery approaches in construction projects.

1. Introduction

1.1. Cost management and the dominant role of Design-to-Cost in construction investment projects

In construction investment project management, cost has long been regarded as one of the central control pillars alongside scope and schedule, commonly conceptualised within the "iron triangle" or "triple constraint." In many practical contexts - particularly for projects financed by public budgets - project success is often assessed primarily in terms of compliance with the approved total investment or cost estimate, rather than in terms of use value, life-cycle performance, or the socio-environmental impacts of the facility [1, 2].

Within this governance logic, Design-to-Cost (DTC, also referred to as designing to cost) has emerged and diffused as a dominant approach, in which design is organised to "fit" a predefined cost limit, while cost becomes the primary benchmark for evaluating design and project management decisions. However, a substantial body of international research has indicated that effective cost management does not necessarily lead to effective value governance, particularly in complex projects with long life-cycles, where value cannot be fully captured through initial capital cost alone [3, 4]. This observation is also consistent with several recent studies in the Vietnamese context. Ngo and Nguyen [5] show that evaluating public building alternatives based on life-cycle costing can provide a more comprehensive basis for decision-making compared to approaches focusing solely on initial investment cost. Similarly, Le and Nguyen [6] demonstrate that design choices made at early stages can lead to significant differences in environmental performance over the entire building life-cycle.

1.2. Design-to-Cost within the current cost management framework in Vietnam

The DTC logic has been systematically embedded within Vietnam's construction investment cost management framework through mechanisms such as total investment and construction cost estimates. According to current legal regulations, basic design, technical design, and cost estimation must comply with the approved total investment through mandatory cost appraisal and approval procedures [7]. In practice, cost control in construction investment projects in Vietnam is primarily implemented through administrative mechanisms such as the establishment of total investment, cost appraisal and approval, and final settlement, with a primary focus on ensuring budget discipline and regulatory compliance rather than supporting design steering and optimisation within cost constraints.

From a governance perspective, the total investment in this context may be interpreted as a form of target cost established early by project owners and state management authorities. However, unlike the traditional DTC approach in construction cost management literature - where cost is used as a control constraint through activities such as cost planning, cost estimating, and cost checking across design stages [8, 9] - target cost in Vietnam is predominantly operationalised through administrative mechanisms involving norms, unit prices, and cost indices, with limited flexibility for adjusting design to optimise value.

International research on Lean Construction and Target Value Design (TVD) emphasises the role of target cost as a design brief for reverse design processes, operationalised through collaborative cost-design feedback loops and early-stage decision-making [10, 11].

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However, it should be noted that these studies do not describe DTC in the traditional cost control sense but rather represent modern variants of target cost-based design in Lean/TVD contexts, where cost functions as a mechanism for design steering and value creation rather than merely a control ceiling.

Notably, Article 14 of Decree No. 10/2021/ND-CP stipulates that the approval of construction cost estimates and design-related costs must be carried out based on the approved total investment [7], and this principle remains in force in the amendments and supplementary regulatory documents of this legislation, such as Circular 11/2021/TT-BXD [12], Decree 35/2023/ND-CP [13], and Circular 14/2023/TT-BXD [14]. This implies that, from the design preparation stage, cost is effectively "fixed" as a mandatory control benchmark, requiring design alternatives to adapt to the predefined cost framework rather than using cost as a starting point for reverse design aimed at optimising value within cost constraints. As a result, in the Vietnamese context, a form of "administrative Design-to-Cost" can be observed, in which cost serves as a central constraint but lacks the organisational mechanisms and supporting tools necessary to transform target cost into a driver for design steering and value creation.

While DTC has been widely discussed in international construction management literature as a managerial approach embedded in project practice, its manifestation in Vietnam differs significantly due to the strong institutionalisation of cost management through legal and administrative mechanisms.

To clarify this distinction, Table 1 contrasts traditional DTC in the international literature with administrative or institutionalised cost control in the Vietnamese context.

Table 1. Comparison between traditional Design-to-Cost and administrative cost control in Vietnam.

Dimension	Traditional DTC (international literature)	Administrative cost control in Vietnam
Nature of system	Managerial approach embedded in project management practice	Institutionalised regulatory framework embedded in state governance
Role of cost	Cost as a constraint guiding design decisions	Cost as a compliance benchmark for approval and verification
Timing of cost influence	Iterative influence across design stages (though often weak in practice)	Fixed early through total investment and enforced throughout approval process
Design–cost relationship	Design adapts to cost through estimation and adjustment	Design must comply with predefined cost norms and approved estimates
Flexibility of adjustment	Moderate (depending on project organisation)	Low (limited flexibility due to regulatory constraints)
Main control mechanisms	Cost planning, estimating, cost checking, value engineering	Norms, unit price systems, appraisal, approval, and final settlement procedures
Information flow	Potential for feedback loops between design and cost	Linear and document-based verification process
Governance logic	Cost-centred but practice-based	Cost-centred and compliance-driven (institutionalised)
Typical outcome	Budget compliance with risk of design lock-in	Strong budget discipline but limited value optimisation and innovation

Source: Author's synthesis based on [8]; [9]; [15]; Decree 10/2021/ND-CP [7], Circular 11/2021/TT-BXD [12]; and subsequent amendments.

Table 1 demonstrates that, although both systems share a cost-centred orientation, they differ fundamentally in their underlying governance mechanisms. In the international literature, DTC operates primarily as a managerial logic embedded within project organisations, where cost is used - although often imperfectly - as a constraint to guide design decisions. In contrast, in Vietnam, cost management is institutionalised through a regulatory framework in which cost is fixed early and enforced through formal appraisal, approval, and verification procedures. This transforms DTC from a managerial approach into an administrative compliance mechanism. As a result, cost in the Vietnamese context functions less as a dynamic input for design steering and more as a rigid benchmark for compliance, thereby limiting flexibility, reducing opportunities for value optimisation, and reinforcing early design lock-in.

1.3. Advantages, limitations, and the incomplete nature of Design-to-Cost in Vietnam

The current approach in Vietnam exhibits several clear advantages, including the ability to control the risk of exceeding total investment, ensure public budget discipline, and establish a unified framework for determining, comparing, and approving costs across projects. At the same time, this mechanism ensures that design consultants cannot separate technical decisions from financial constraints, thereby limiting "over-designed" solutions that are not aligned with available resources.

However, because cost is primarily controlled through norms, capital cost indicators, unit prices, and cost ratios [7], the design process tends to shift toward a logic of "designing to comply with norms" rather than "designing to maximise value within a target cost." This results in

early design lock-in and provides limited incentives to explore alternative technical solutions, materials, or organisational models that could deliver higher value within the same cost framework - an issue long identified in international research as a major barrier to innovation and value optimisation in construction investment projects [16].

This can therefore be considered an "incomplete Design-to-Cost" approach: cost acts as a strong constraint but is not accompanied by the necessary organisational mechanisms, collaborative tools, and decision-making processes required to transform target cost into a driver of value creation, rather than merely an administrative control ceiling.

1.4. Theoretical gap and the need to clarify underlying assumptions

The characteristics outlined above suggest that the limitations of DTC do not stem solely from specific tools or processes but rather reflect deeper theoretical assumptions regarding the relationship between cost, design, and value in construction investment projects. In many cases, cost compliance is implicitly equated with project success; value is assumed to be preserved through ex-post cost control; and initial investment cost is prioritised over other dimensions of value such as life-cycle performance or user benefits [1, 2].

These assumptions are rarely explicitly articulated in cost management literature but instead exist as implicit premises that shape how projects are designed, organised, and evaluated. They are typically addressed only indirectly and are seldom analysed systematically, thereby limiting a proper understanding of DTC as a value governance logic rather than merely a technical cost control method. This creates a theoretical gap that needs to be clarified before alternative approaches can be meaningfully proposed [17].

1.5. Research objectives and positioning of the paper

Building on the issues outlined above, this paper is positioned as a foundational study aimed at reframing the understanding of DTC in construction project cost management. Rather than treating it as a neutral technical method, the paper approaches DTC as a dominant governance logic, sustained by implicit assumptions and institutionalised through specific project practices.

Accordingly, the paper focuses on clarifying: (i) the theoretical foundations of DTC in traditional cost management; (ii) the implicit assumptions underlying this approach; and (iii) the structural limitations that emerge in project practice. In doing so, the paper establishes a conceptual foundation for examining more advanced, value-oriented governance approaches in subsequent research, particularly in response to increasing pressures on construction investment projects related to life-cycle performance, user benefits, and sustainability - issues that are increasingly reflected in recent Vietnamese studies on building life-cycle cost, emissions, and energy [5, 6, 18].

Accordingly, Section 2 first systematises the concept, terminological variants, and operational mechanisms of DTC in construction, providing a foundation for the theoretical and critical analyses presented in the subsequent sections.

2. Design-to-Cost in Construction: Concept, Governance Logic, and Design Steering Mechanisms

2.1. Concept of Design-to-Cost in construction investment projects

Design-to-Cost in construction investment projects is understood as an approach in which a target cost is established early and used as a primary constraint governing the development of design, rather than being a result that emerges after design completion. Under this approach, design is not developed independently and subsequently checked for financial feasibility, but must continuously adapt to the predefined cost limit through cost estimating, cost checking, and cost adjustment activities throughout the design process [8, 19].

In previous studies on cost management and construction economics, DTC is not always explicitly labelled. However, its logic is deeply embedded in practices of cost planning, cost control, and project success evaluation, where budget compliance is considered the central criterion [9]. In this sense, DTC is not merely a set of technical tools but reflects a specific understanding of the relationship between cost, design, and value in construction projects.

2.2. Cost-centred governance logic in Design-to-Cost

The core governance logic of DTC in construction can be described as a cost-centred governance logic, in which initial investment cost serves as the dominant benchmark shaping decision-making processes. Under this logic, project success is equated with budget compliance, while other dimensions of value - such as use value, life-cycle performance, and social impacts - are often placed in a secondary position [1, 2].

Within this governance framework, design is treated as an adjustable variable that can be modified to fit the established cost constraint. The selection and evaluation of design alternatives are primarily based on their ability to conform to the cost framework, rather than on an analysis of the value they generate. This logic underpins traditional cost control mechanisms and simultaneously shapes a narrow understanding of project value.

2.3. Design-to-Cost and related terminology

Although cost-oriented design approaches share a common principle of introducing cost considerations early in the project lifecycle, they differ fundamentally in their underlying governance logic, the timing of cost influence, and the role of value in decision-making. To clarify these distinctions, this study differentiates DTC from related approaches, including Target Costing (TC), Designing to Target Cost (DgTC), and TVD, as summarised in Table 2.

In previous international studies, DTC often appears alongside or

is represented through related concepts such as TC and DgTC. These approaches share the idea that cost should not merely be a result of design, but rather an input that shapes design decisions. However, they differ significantly in their degree of proactiveness, organisational integration, and conceptualisation of value (Cooper & Slagmulder, 1997; Jørgensen, 2005; Pennanen et al., 2011).

Target Costing, originally developed in manufacturing, derives allowable cost from market conditions and expected profit margins, and then aligns design decisions accordingly (Cooper & Slagmulder, 1997; Cooper, 2017). When adapted to construction, this approach introduces a more proactive orientation compared to traditional DTC, although its implementation often remains partially sequential and cost-focused.

Designing to Target Cost represents a further development, particularly within construction contexts influenced by Lean thinking. As argued by Jørgensen (2005), this approach does not merely aim to "keep design within a cost ceiling," but instead positions target cost as the starting point for design, requiring early and continuous integration among design, construction, and supply chain actors. In this sense, cost becomes a dynamic input to the design process, enabling iterative cost–design feedback loops rather than ex-post adjustment.

Target Value Design extends this logic further by fundamentally reframing the relationship between cost and value. Within TVD, cost is no longer treated as the primary objective, but as a constraint derived from explicitly defined value targets. This approach emphasises collaborative decision-making, early stakeholder engagement, and continuous alignment between design solutions and value objectives (Ballard, 2012; Zimina et al., 2012). As such, TVD represents a shift from cost control toward value-oriented governance in construction project delivery.

These distinctions are synthesised in Table 2, which highlights the differences in governance logic, timing, collaboration, and value orientation across these approaches.

Table 2 highlights that while these approaches share a common concern with cost, they embody fundamentally different governance logics. Design-to-Cost represents a cost-centred governance model, in which cost operates as a constraint imposed on design, typically through ex-post control mechanisms. In contrast, TC and Design to Target Cost introduce progressively earlier and more proactive uses of cost as a design input, enabling iterative adjustments and partial alignment between cost and value considerations. Target Value Design represents a more radical shift, in which cost is derived from value objectives and embedded within collaborative and integrated decision-making processes.

From this perspective, DTC can be understood as an early-stage and structurally limited form of cost-based governance, lacking the organisational mechanisms required to support value-oriented design. In the Vietnamese context, as discussed in Section 1.2, cost management practices remain closer to the DTC logic, particularly in their reliance on administrative cost fixing and compliance-based appraisal mechanisms.

Table 2. Conceptual distinction between cost-based design approaches in construction.

Dimension	DTC	TC	DgTC	TVD
Origin discipline	Construction cost management	Manufacturing / product development	Construction (lean-influenced)	Lean Construction
Primary objective	Cost compliance	Market-driven cost control	Cost-informed design steering	Value optimisation within cost
Role of cost	Constraint (ceiling)	Target derived from market	Design input / feedback signal	Derived from value
Timing of cost influence	Late / ex-post	Early	Early & iterative	Continuous & integrated
Design–cost relationship	Design adapts to cost	Design adjusted to meet target	Co-evolution of cost and design	Design driven by value, cost as constraint
Governance logic	Cost-centred	Cost–market alignment	Cost-informed coordination	Value-centred governance
Collaboration level	Low (fragmented)	Medium	High	Very high (integrated team)
Decision-making mode	Sequential	Partially iterative	Iterative	Fully collaborative
View of value	Secondary to cost	Market-defined	Considered but limited	Central objective
Typical tools	Estimating, cost checking, VE (late)	Cost breakdown, benchmarking	Cost-design loops	Set-based design, collaborative planning
Typical outcome	Budget compliance, design lock-in	Cost control with some optimisation	Improved coordination	High value, lifecycle optimisation

Source: Author's synthesis based on [20]; [21]; [22]; [11]; [23]; [24].

2.4. Cost-based design steering mechanisms in Design-to-Cost

Recent studies indicate that DTC in construction does not operate solely as an abstract governance logic but is realised through mechanisms that steer the design process. According to Pennanen and Ballard [22], target cost can be used as a feedback signal to adjust design decisions under conditions of high uncertainty, through iterative cost-design feedback loops.

Jørgensen [21] emphasises that, in the designing-to-target-cost approach, cost is not a "result to be checked," but a direct input into the design process, enabling early guidance of decisions regarding spatial configuration, technical solutions, and construction organisation. In theory, this mechanism has the potential to reduce design lock-in and support value optimisation within cost constraints.

However, as will be discussed in subsequent sections, in traditional construction project practice, these steering mechanisms are often weakened or implemented too late, causing DTC to operate more as a mechanism of control and correction rather than proactive design steering.

2.5. *Implementation tools and limitations of design steering mechanisms in practice*

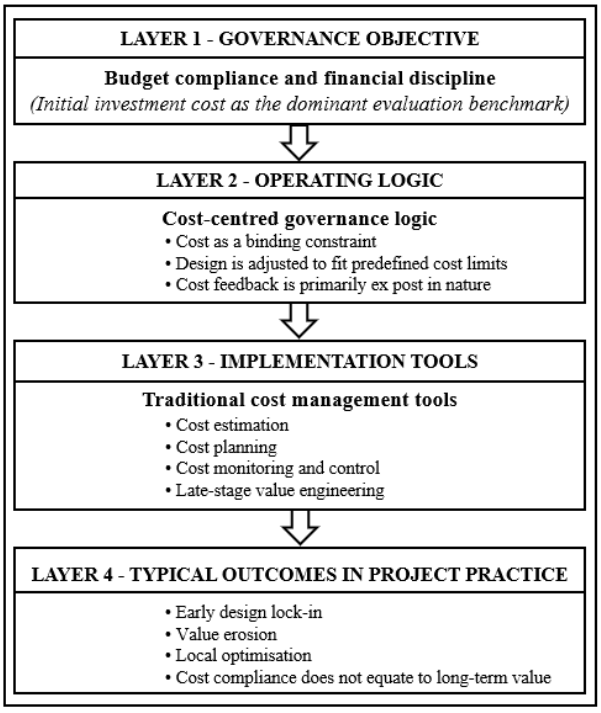

Figure 1. Conceptual framework of Design-to-Cost in traditional construction investment project cost management. (Source: Author)

In construction investment project practice, DTC is implemented through a set of familiar cost management tools, including cost planning across design stages, cost estimating and checking, budget variance analysis, and late-stage value engineering [3, 8, 19].

Although these tools contribute to controlling expenditure within budget, their linear and fragmented implementation makes it difficult to establish rapid and effective feedback loops between cost and design. As Jørgensen [21] points out, in the absence of early collaborative mechanisms and transparent cost information sharing, target cost is likely to become a "control ceiling" rather than a tool for design steering.

These limitations provide the foundation for the implicit assumptions and structural consequences of DTC, which will be analysed in detail in the subsequent sections of the paper.

In summary, within traditional construction investment project cost management, DTC can be understood not only as a set of technical tools, but as a cost-centred governance logic, in which initial investment cost serves as the dominant evaluation benchmark, while design primarily operates through adaptation to pre-established budget constraints. The conceptual framework of this approach - including its governance objectives, operational logic, implementation tools, and typical consequences in project practice - is summarised in Figure 1.

Figure 1 illustrates how DTC operates as a cost-centred governance logic, in which budget compliance and financial discipline serve as the primary governance objective. This logic is operationalised through traditional cost management tools, including cost estimation, cost planning, cost checking, and late-stage value engineering. At the same time, it leads to typical outcomes in project practice, including early design lock-in, value erosion, and a disconnect between cost compliance and long-term value.

3. Methodological Approach: Conceptual Literature Review

3.1. *Research design and analytical orientation*

This study adopts a conceptual and critical literature review, with the objective not of providing a comprehensive synthesis or statistical mapping of research trends, but of elucidating the underlying governance logic that shapes the DTC approach in construction investment project cost management.

Unlike systematic reviews or bibliometric analyses - which emphasise coverage, screening procedures, and citation frequency - the approach of this paper focuses on interpreting, comparing, and reconstructing the underlying theoretical arguments implicitly embedded in traditional cost management practices. The analytical emphasis is therefore not on "how many studies have been published," but on how research, standards, and management guidelines collectively share a common logic that governs design decision-making and the evaluation of project success.

Accordingly, the review process is organised around two main analytical dimensions. First, the study clarifies the decision-making logic reflected in the ways cost is used to control and evaluate design, including the role of cost as an ex-post constraint, the sequence of design, estimation, and adjustment, and the relationship between cost control and project success evaluation. Second, the study focuses on identifying and unpacking the implicit assumptions underlying this approach, particularly those related to the nature of value, the role of design in value creation, and the equation of budget compliance with project effectiveness.

This approach clarifies that DTC is not merely a set of technical tools, but represents a specific value governance logic with structural implications for project practice. The choice of a conceptual and critical literature review is therefore appropriate for the objective of reframing

the understanding of traditional cost management, rather than proposing or empirically testing a new model [17].

3.2. Scope and sources of literature

The literature used in this study is purposefully selected to reflect the dominant line of thinking in construction cost management and project management, rather than to comprehensively cover all related studies. The search and selection process follows a strategy of searching, screening, and interpretation and continues until reaching a threshold of explanatory saturation.

This threshold is understood as the point at which additional sources no longer provide new explanatory mechanisms or underlying assumptions related to the governance logic of DTC, rather than saturation in terms of the number of studies or citation frequency. This interpretation aligns with the nature of conceptual literature reviews, in which the value of sources is assessed based on their explanatory contribution rather than statistical coverage.

For international sources, the search is conducted primarily through indexed academic databases such as Scopus, complemented by Google Scholar to access full-text documents. The focus is on articles published in leading journals in the fields of construction management, project management, cost engineering, and value management. Keywords such as design-to-cost, target costing, cost control, value management, and value governance are used iteratively and expansively to trace foundational works as well as influential studies within each line of thought.

For the Vietnamese context, the sources include specialised journals such as Journal of Construction, Journal of Materials and Construction, and Journal of Science and Technology in Civil Engineering, along with legal documents and guidelines related to construction investment cost management. These sources are used to clarify how cost management logic is institutionalised in practice, rather than to conduct empirical analysis or quantitative comparison across projects.

In terms of content, the literature is organised into three main groups. The first group consists of books and academic articles in cost engineering, construction economics, and project management, providing the foundation for understanding how cost is conceptualised as a central control variable in projects [8, 9]. The second group includes international project management standards and frameworks, notably those of the Project Management Institute (PMI) [15] and FIDIC contract conditions [25], which are used to represent mainstream cost governance logic through baselines, control mechanisms, and deviation management processes. The third group comprises seminal studies on cost overruns and value engineering, particularly those analysing systemic causes of cost overruns, optimism bias, and value trade-offs in construction and infrastructure projects [2, 4].

Through the selective synthesis and interpretation of these sources, the study aims to construct a coherent conceptual argument, clarifying the theoretical foundations and inherent limitations of DTC, while providing a basis for introducing alternative value-oriented governance approaches in subsequent sections of the paper.

The comparative analyses presented in this study follow a structured and cumulative logic. First, Table 1 contrasts traditional DTC in the international literature with administrative cost control in the Vietnamese context, highlighting how this governance logic is institutionalised differently in practice. Second, Table 2 distinguishes DTC from related cost-based design approaches, clarifying its position within the broader conceptual landscape and identifying its structural limitations relative to more advanced value-oriented approaches. Finally, Table 4 contrasts cost compliance with multidimensional project success, revealing the consequences of this governance logic in project outcomes. These comparative perspectives help clarify the analytical logic of the paper and reinforce its central argument of the paper regarding the structural limitations of DTC and the need for a shift toward value-oriented governance.

4. Theoretical Foundations of Design-to-Cost in Traditional Cost Management

To clarify the theoretical foundations of DTC, this paper adopts a conceptual argument framework presented in Figure 2. This framework illustrates how a cost-centred governance logic shapes the DTC approach in traditional cost management, while also indicating the relationships between this logic, its underlying assumptions, its practical consequences in project contexts, and the need to transition toward value-oriented governance approaches.

As illustrated in Figure 2, DTC operates not merely as a set of cost control tools, but as a dominant governance logic in which cost serves as the primary evaluation benchmark. This logic enables the formation of implicit assumptions regarding cost and value, which are subsequently institutionalised into structural limitations in project practice and give rise to the need for rethinking value governance in the construction sector.

Building on this conceptual framework, Section 4 focuses on analysing the theoretical foundations and cognitive mechanisms that have led DTC to become a dominant approach in traditional construction investment project cost management. The implicit assumptions and practical consequences illustrated in Figure 2 will be examined in greater detail in Sections 5 and 6, in order to clarify the governance nature of this approach.

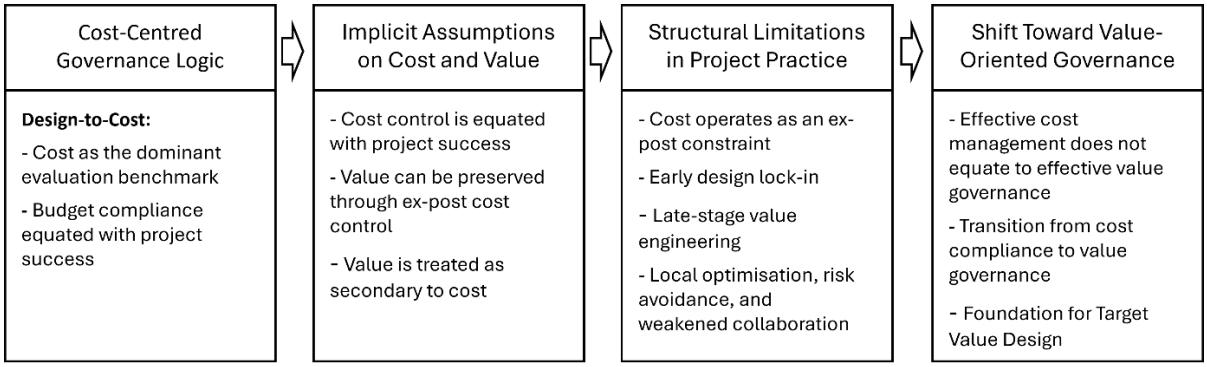

Figure 2. Chain of reasoning from cost-centred governance logic to the need for a shift toward value-oriented governance in construction investment projects. (Source: Author)

4.1. Design-to-Cost in Cost Engineering and Construction Economics

In the fields of cost engineering and construction economics, DTC has been established and reinforced as a practical approach closely associated with the objective of controlling investment budgets. Under this logic, design is developed within a cost ceiling determined from the early stages of the project, typically based on the approved total investment or preliminary cost estimate. The core task of the design process is to ensure that technical solutions do not exceed this cost limit, rather than proactively exploring alternatives for value optimisation [8].

Within this approach, cost is treated as a constraint variable rather than a strategic variable capable of guiding design decisions. Design therefore adapts to cost, rather than cost being co-developed alongside design. This conceptualisation reflects a fundamental characteristic of traditional cost management, in which cost functions as a limit within which the design process must remain [9].

The core tools of DTC in cost engineering practice include cost estimating, cost planning, and cost checking. Cost estimating is used to approximate the cost of design solutions at different stages; cost planning allocates costs across components and phases; and cost checking compares design solutions against established budget limits. However, these tools primarily operate on an ex post feedback logic, whereby evaluation and adjustment take place only after key design decisions have already been made [8].

As a result, although cost engineering techniques have become increasingly sophisticated, the ability of DTC to shape early value-creating decisions remains structurally constrained.

4.2. Design-to-Cost in Standardised Project Management Frameworks

The logic of DTC is also clearly reflected in international standardised project management frameworks, where cost management is organised as a control function relatively separated from the design process.

In guidelines issued by the PMI, project cost management revolves around establishing a cost baseline, monitoring cost deviations, and implementing cost control measures to ensure that the project does not exceed the approved budget [15]. While this approach emphasises financial discipline and predictability, it also reinforces the notion that cost functions primarily as a benchmark for design compliance, rather than as a strategic lever for reshaping design decisions to enhance value.

Similarly, in standard contract conditions issued by FIDIC, cost-related mechanisms - such as quantity adjustments, design changes (variations), and claims management - are primarily designed to manage the financial consequences of changes, rather than to facilitate the co-creation of value among project stakeholders from the early design stage [25]. In such contexts, design is often effectively "locked in" before cost-related issues are systematically addressed.

A common characteristic of these standardised frameworks is that cost is managed after major design decisions have been made. This results in a linear decision-making sequence in which design drives cost, while cost can only react to design through limited control or corrective measures.

4.3. Value Engineering within the Design-to-Cost Logic

Within the DTC context, value engineering is often regarded as a supplementary tool for addressing cost-related issues. However, in traditional project management practice, value engineering is typically introduced at a late stage of the design process, when the budget is already under threat or has exceeded allowable limits [3].

The late implementation of value engineering shifts the focus from value optimisation to cost reduction. Rather than exploring how a facility can deliver greater use value for users or improved lifecycle value for the client, value engineering within the DTC logic is often reduced to cost-cutting measures, for example, eliminating components, reducing material usage, or lowering technical standards [26].

This conflation of value engineering with cost reduction not only distorts the original intent of the technique, but also reinforces a narrow understanding of value in construction investment project management. In this context, value is reduced to the ability to comply with budget constraints, while other important dimensions - such as functional

performance, long-term adaptability, and socio-environmental impacts - are rarely considered in a systematic manner.

The core characteristics of the governance logic underlying DTC are summarised in Table 3, illustrating how cost is used as an ex-post constraint and how this shapes the relationship between design, value, and project success criteria.

The governance characteristics identified in Table 3 do not merely describe observable patterns of cost management in practice but also provide the conceptual foundation for the three core assumptions developed in Section 5. In particular, the dominance of cost as an evaluation benchmark and the reduction of project success to budget compliance underpin the first assumption, in which project value is implicitly equated with cost performance. The ex-post role of cost and the adaptation of design to pre-defined cost constraints form the basis of the second assumption, whereby cost functions as a limiting condition rather than a guiding instrument. Finally, the marginalisation of value considerations beyond initial investment cost supports the third assumption, in which project value is reduced to not exceeding the approved budget.

In this sense, the three assumptions can be understood as theoretical abstractions of the governance logic captured through the comparative analysis, thereby providing a coherent transition from the analytical framework in Section 4 to the conceptual development in Section 5.

Table 3. Governance Logic Characteristics of Design-to-Cost in Construction Investment Projects.

Analytical Aspect	Design-to-Cost
Role of cost	Cost is treated as a constraint to be complied with, serving as the dominant evaluation benchmark of the project
Timing of cost influence on design	After major design decisions have been made, through cost estimating and cost checking
Relationship between cost and design	Design adapts to cost, rather than cost being developed based on design value
Management approach	Cost management is ex post in nature, focusing on deviation control
Understanding of project value	Value is reduced to not exceeding the investment budget
Primary management tools	Cost estimating, cost planning, and cost control
Criteria for project success	Cost compliance and budgetary discipline
Typical consequences in practice	Early design lock-in, value erosion, and reduced design quality and life-cycle performance

Source: Author's synthesis based on studies on construction cost management and project management, namely [8]; [9]; [15]; [3]; [2]

5. Implicit Assumptions Underlying the Design-to-Cost Approach

As summarised in Table 3, the governance logic of DTC places budget compliance at the centre, thereby giving rise to a set of implicit assumptions that shape how projects are designed and evaluated. Although DTC is often presented as a neutral set of technical tools for budget control, in practice it is sustained by underlying cognitive premises regarding cost, value, and project success.

These assumptions are rarely explicitly articulated in cost management research, yet they exert a decisive influence on how design decisions are made, which alternatives are prioritised, and how project outcomes are assessed. Clarifying these foundational assumptions is therefore essential to understanding why DTC, despite its effectiveness in ensuring budget compliance, often leads to structural limitations in value creation.

5.1. Assumption 1: Cost control is equated with cost compliance

The first foundational assumption of DTC is the equation of cost control with cost compliance, whereby not exceeding the budget is treated as the central indicator of project success. Under this logic, a project is considered successful if actual costs remain within or below the approved cost limit, regardless of consequences related to functional quality, operational performance, or long-term value.

(1) Origins of the assumption in cost governance logic

This assumption is formed and reinforced within traditional project governance systems, where initial investment cost serves as the dominant evaluation benchmark. In many projects - particularly those financed by public funds - auditing, appraisal, and financial supervision mechanisms are structured around ensuring budgetary discipline and regulatory compliance. As a result, cost overruns are often treated as indicators of management failure rather than signals to be interpreted in relation to the value achieved [3].

In this context, cost compliance gradually becomes an end in itself, rather than a means to achieve broader value objectives. Flyvbjerg [2] highlights that many infrastructure projects are still considered "successful" under budget-based criteria, despite failing in terms of socio-economic performance, usability, or life-cycle efficiency. Conversely, projects that deliver superior value for users or society may still be evaluated negatively if they exceed initial budget estimates.

Earlier empirical studies in Vietnam had already reported that rigorous budget control did not necessarily prevent cost overruns and implementation inefficiencies in large construction projects [27]. More recent evidence suggests that this compliance-oriented logic remains embedded in state-funded cost appraisal and verification practices

under the current regulatory framework [28]. This raises fundamental questions regarding the assumption that cost control is equivalent to project effectiveness.

The cognitive consequence of this assumption is a systematic decoupling between cost and value in project evaluation. When budget compliance is placed at the centre, project value is reduced to the ability to "not exceed cost," while other important dimensions - such as usability, operational efficiency, long-term adaptability, and socio-environmental impacts - are insufficiently considered. In this sense, the assumption that "cost control equals cost compliance" not only limits how project success is assessed but also lays the foundation for the structural limitations of DTC in practice, which will be further analysed in subsequent sections.

5.2. Assumption 2: Value can be preserved through ex-post cost control

The second implicit assumption is that project value can be preserved or adjusted through ex-post cost control mechanisms, even after major design decisions have already been made. Under this view, design is treated as value-neutral, while cost functions as a corrective instrument to bring the project "back on track" when there is a risk of exceeding the budget.

This assumption reflects a linear understanding of the relationship between design and cost, in which design decisions are assumed to be "correctable" through financial interventions at later stages. Such an approach often fails to fully acknowledge the lock-in effect, whereby early design decisions strongly constrain the potential for value creation in subsequent stages [27].

Moreover, this assumption overlooks the path dependency of the design process, in which early decisions not only determine cost but also shape how problems are identified and addressed later. Within this framework, ex-post cost control is expected to restore value, whereas in reality, the scope for intervening in core design decisions has already been significantly reduced.

Earlier Vietnamese studies on infrastructure projects suggested that many cost overrun risks were rooted in early-stage decisions on surveys, design, and investment management [29]. This diagnosis appears to remain relevant under the current state-funded cost management regime, where design approval and cost verification continue to operate primarily as compliance mechanisms rather than collaborative value-steering processes [7, 12-14].

5.3. Assumption 3: Value is a secondary concept relative to cost

The third implicit assumption - and arguably the most influential - is the treatment of value as a secondary concept relative to cost. Within the DTC logic, value is often reduced to the ability to "not exceed budget," while other dimensions of value are rarely considered systematically.

This reduction leads to the neglect or undervaluation of critical aspects of project value, including use value, life-cycle value, and socio-environmental value associated with the long-term impacts of the facility [3]. When value is positioned as secondary, design decisions tend to prioritise solutions that meet short-term cost constraints, even if such solutions compromise operational efficiency, long-term adaptability, or sustainability.

6. Structural Limitations of Design-to-Cost in Project Practice

The implicit assumptions analysed in Section 5 do not exist solely at the cognitive level, but are institutionalised into organisational mechanisms, management processes, and behavioural patterns in project practice. When repeatedly enacted within traditional project management systems, these assumptions give rise to structural limitations that reduce the capacity of DTC to guide value-creating decisions. This section analyses three representative groups of structural limitations, thereby clarifying how DTC both shapes and constrains construction investment project practice, particularly in governance contexts where cost serves as the dominant evaluation benchmark.

6.1. Cost as an ex-post constraint rather than a guiding instrument

The first structural limitation lies in the use of cost primarily as an ex-post constraint, rather than as an instrument for guiding design from the outset. In traditional project sequences, key design decisions - relating to functionality, form, structural systems, and technologies - are typically made before cost information becomes sufficiently developed to exert a substantive influence on decision-making [8].

As a result, DTC operates according to a reactive rather than a guiding logic. By the time cost information becomes operationally salient, most value-creating decisions have already been locked in, leaving cost control measures to operate only at the level of local adjustments, rather than enabling the restructuring of fundamental design choices [9]. In other words, the cost-based design steering mechanisms outlined in Section 2 are not activated early enough to function as iterative cost-design decision loops. Instead, cost feedback appears primarily as post-decision compliance checking, thereby weakening the role of cost as a value-oriented steering instrument.

In Vietnam, this reactive pattern has been reported in earlier project studies [29] and is still consistent with the current appraisal–verification architecture of state-funded projects, in which cost checking is mandatory prior to approval and is closely tied to normative datasets, unit price books, and spreadsheet-based verification workflows [30]. Similarly, Vu and Wang [29] and colleagues show that cost management is predominantly implemented through quantity control, payment processes, and final account settlement, while fundamental design decisions are effectively "frozen" at early stages, significantly limiting the potential for design adjustments to enhance value in later phases. In such contexts, cost management becomes an activity of "correcting deviations" rather than a proactive instrument for value creation.

The following example is based on practical project documentation but is presented in a generalised and anonymised form to illustrate the mechanism discussed above.

In one state-funded healthcare construction project, the initial investment decision approved a comprehensive design scheme that included several functional components beyond the core clinical facilities, such as auxiliary service and public-use spaces. However, during subsequent stages of detailed design and cost verification, more accurate estimation revealed that the projected cost would exceed the approved total investment. As a result, instead of revisiting the underlying value objectives or reassessing the functional role of different project components, the project was required to adjust the design to comply with the pre-approved cost limit. This adjustment led to the removal of certain non-core facilities and the simplification of the overall design programme. While these changes enabled the project to remain within the approved budget, they also reduced the diversity of functions and potentially limited the long-term usability and service capacity of the facility.

This example illustrates a typical pattern under the DTC logic, in which cost operates as a rigid ex-post constraint rather than as a guiding instrument for value-oriented design decisions.

6.2. Design lock-in and reduced capacity for value creation

While Section 5 analysed lock-in as an implicit assumption in managerial thinking, at the level of project practice this assumption becomes institutionalised as a clear structural limitation. Once core decisions regarding layout, structural systems, or technologies have been approved, the capacity to adjust design in order to enhance value becomes severely constrained.

In this context, cost control is no longer capable of reversing suboptimal design decisions but can only intervene through cost-cutting measures. The late implementation of value engineering often results in value erosion, as originally value-generating elements are removed to meet budget constraints, while design quality is degraded through the lowering of technical standards or the reduction of long-term flexibility [3, 27].

Rather than optimising overall value, such late interventions tend to shift cost burdens from the investment phase to the operation phase, thereby generating life-cycle cost issues that DTC - focused primarily on initial investment cost - lacks the tools to address in a systematic manner.

As illustrated in the example above, once project decisions are adjusted to comply with fixed cost constraints, the capacity to enhance value through subsequent design development becomes significantly limited.

6.3. Organisational and behavioural consequences in project practice

Beyond technical limitations, DTC also generates significant organisational and behavioural consequences in project practice. When cost compliance becomes the central evaluation criterion, project actors tend to optimise locally, focusing on their own scope of responsibility rather than pursuing overall project value optimisation [1].

This mechanism also encourages risk-averse behaviour, whereby stakeholders favour familiar and cost-controllable solutions, even when such solutions limit innovation or reduce use value. At the same time, the use of cost information as a control instrument rather than as a medium for dialogue tends to weaken interdisciplinary collaboration, making it difficult for design, construction, and operation teams to develop a shared vision of project value [4].

In this sense, these organisational and behavioural consequences are not isolated “implementation failures,” but rather logical outcomes of a cost-centred governance mechanism - where cost functions both as an evaluation benchmark and as a disciplinary tool yet lacks the institutional arrangements necessary to support collaboration and value governance.

The example above also illustrates how cost-driven adjustments can shape organisational and behavioural patterns, reinforcing a focus on compliance over value-oriented collaboration.

7. Discussion: From Design-to-Cost to the Need for Rethinking Value Governance

The analyses presented in Sections 4, 5, and 6 indicate that DTC is not merely a set of cost management tools but reflects a dominant governance logic that shapes how construction investment projects are organised, how decisions are made, and how success is evaluated. This logic can be characterised as cost-dominated governance, in which initial investment cost becomes the primary evaluation benchmark, shaping both the design process and project implementation.

Within this governance framework, cost is used as a compliance benchmark, while design primarily serves an adaptive role, adjusting to predefined budget constraints. Management mechanisms - from cost estimating and cost planning to deviation control - are organised around the objective of cost compliance, rather than facilitating early dialogue and shared understanding of the value that the project is intended to deliver. As highlighted in project governance literature, this logic is reinforced through management standards, contractual arrangements, and accountability systems, particularly in public investment contexts or projects subject to high levels of financial oversight [1, 2].

However, a fundamental contradiction emerges from the DTC logic: effective cost control does not necessarily lead to effective value delivery. A project may remain within budget and comply with financial requirements, yet fail to deliver expected usability, lifecycle performance, or socio-economic benefits. This contradiction reflects a deeper conceptual limitation, in which project success is implicitly equated with cost compliance, while value is treated as secondary or assumed to be preserved through cost control. As contemporary construction increasingly recognises project success as a multidimensional concept, this assumption becomes increasingly problematic. To clarify this distinction, Table 4 contrasts the cost

compliance perspective embedded in DTC logic with a broader, value-oriented understanding of project success.

Table 4 does not merely distinguish between cost compliance and project success but reveals a structural misalignment between the evaluation logic embedded in DTC and the multidimensional nature of project value. Rather than functioning as a comprehensive measure of success, cost compliance captures only a narrow dimension of project performance. When elevated to the dominant evaluation criterion, it systematically marginalises other critical dimensions, including lifecycle performance, adaptability, and socio-environmental outcomes. This misalignment explains why projects can be simultaneously "successful" in financial terms yet underperform in delivering long-term value.

From this perspective, the limitations of DTC are not merely technical issues that can be resolved through improved estimation or stricter control mechanisms. Rather, they reflect a deeper governance misalignment, in which cost is treated as an end in itself rather than a means to achieve value. This highlights the need to shift toward value-oriented governance approaches, in which cost is reframed as a constraint derived from value objectives. Approaches such as TVD represent potential pathways for this transition, although their detailed examination lies beyond the scope of this paper.

Table 4. Cost compliance versus multidimensional project success in construction projects.

Evaluation criteria	Cost compliance perspective (Design-to-Cost logic)	Project success perspective (value governance logic)
Staying within budget	Primary objective and main success criterion	Necessary but not sufficient condition
Usability / functional performance	Often assumed to be preserved if cost is controlled	Explicitly defined and evaluated as core outcome
Lifecycle performance	Rarely considered systematically	Central to long-term value assessment
Adaptability / flexibility	Frequently reduced due to cost constraints	Considered as a key component of long-term value
Socio-environmental value	Typically external to cost evaluation	Integrated into decision-making and evaluation
Long-term benefits	Not explicitly assessed	Core dimension of project success
Decision-making focus	Cost minimisation and compliance	Value optimisation within constraints
Typical outcome	Budget compliance with risk of value erosion	Balanced performance across multiple value dimensions

Source: Author's synthesis based on [2]; [1]; [3]; [4]; [11]; [23]

8. Conclusions

This paper has approached DTC not as a purely technical set of cost management tools, but as a specific value governance logic deeply embedded in traditional construction investment project management practice. Through a conceptual and critical literature review, the study has demonstrated that DTC is sustained by a chain of implicit assumptions regarding the roles of cost, design, and value, in which budget compliance is positioned at the centre of project success evaluation.

The core theoretical contribution of this paper lies in reframing the understanding of DTC - from a "neutral" cost control method to a dominant governance mechanism that shapes decision-making, responsibility allocation, and the evaluation of project outcomes. This perspective helps explain why, despite increasingly sophisticated cost estimating and control techniques, many projects continue to struggle to deliver use value, life-cycle performance, and sustainable socio-economic outcomes.

The theoretical findings suggest that the limitations of DTC cannot be addressed merely by improving estimation accuracy or strengthening cost control mechanisms. Rather, these limitations reflect fundamental constraints of a cost-centred governance logic, in which cost is prioritised as the dominant evaluation benchmark while value is positioned as secondary. This highlights the need to rethink value governance in construction investment projects, particularly in contexts where projects are becoming increasingly complex and subject to multidimensional economic, social, and environmental pressures.

In contexts where cost management is strongly institutionalised and administrative in nature, such as in Vietnam, DTC tends to operate primarily as a compliance mechanism rather than a proactive design strategy aimed at value optimisation. The early "fixing" of cost through total investment and systems of norms and unit rates makes the structural limitations of this approach particularly evident, while also highlighting the gap between cost control and long-term value creation in project practice.

From a research perspective, the findings of this paper open up a research agenda aimed at reconceptualising the role of cost in project management - not merely as a constraint to be complied with, but as a means to achieve clearly defined value objectives. In this context, value-oriented governance approaches - particularly TVD and its extensions such as Target Value Delivery - can be considered promising research directions for restructuring the relationship between cost, design, and value from the early stages of projects.

From a practical perspective, the paper suggests that the continued mechanical application of DTC - especially in projects with high demands for life-cycle performance and sustainability - may undermine long-term value creation objectives. Instead, project owners and managers should consider governance mechanisms that enable early dialogue on value, interdisciplinary collaboration, and decision-

making based on value objectives, even if this requires adjustments to conventional practices of cost control and financial accountability.

This paper has clarified the theoretical foundations and inherent limitations of DTC as a dominant governance logic in construction investment project cost management. However, identifying these limitations is only an initial step.

Building on this, future research will address the following central question:

Why does the Design-to-Cost logic, despite being widespread and highly institutionalised, often fail to deliver sustainable project value?

Subsequent studies will extend the analysis to theoretical frameworks in organisational behaviour, institutional economics, and project governance, in order to explain the mechanisms through which DTC reproduces value-related problems in project practice - while also establishing a theoretical foundation for introducing TVD as a systematic alternative approach.

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