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GENERATIVE DESIGN AS AN INTEGRATED VALUE DELIVERY TOOL

Diego Rojas Marinkelle[1], Nelly P Garcia-Lopez[2], & Santiago Lara[3]

ABSTRACT

Delivering value to the client is a core principle of Lean Construction. However, its realization during the design stage remains challenging due to fragmented stakeholder perceptions, sequential workflows, and strict time constraints. Even with the adoption of integration-oriented methodologies such as Building Information Modeling (BIM), design processes in construction projects often follow discipline-based, waterfall logics that limit early integration and value validation. Generative design is a design approach that systematically produces multiple design alternatives that satisfy defined project objectives. This study examines how generative design contributes to the integration of value across multiple stakeholders during the design stage of construction projects. Using a qualitative inductive approach, semi-structured interviews with design and construction professionals were analyzed using the Gioia methodology. The findings indicate that time acts as a structural constraint that reinforces sequential workflows, restricts design exploration, and progressively degrades design quality and value delivery. Value emerges as a multidimensional and relational construct shaped by a network of stakeholder interpretations. The study positions generative design as a mechanism that enables early integration of value networks through the simultaneous evaluation of multiple alternatives using quantifiable criteria, thereby supporting more integrated value delivery consistent with Lean principles.

KEYWORDS

Generative design, value delivery, value integration, lean design.

INTRODUCTION

Delivering value to the client constitutes one of the fundamental principles of Lean approaches in the construction industry (Koskela, 2000). Nevertheless, the materialization of value within design processes remains a significant challenge, particularly in contexts characterized by high complexity, multiple stakeholders, and strong time and cost constraints. In practice, design processes are frequently organized in a sequential and discipline-based manner, following waterfall-type logics, even when integration-oriented methodologies such as Building Information Modeling (BIM) are adopted (Abrishami et al., 2021). These dynamics limit the exploration of alternatives, constrain early cross-disciplinary integration, and hinder the continuous validation of client value throughout the design process.

The literature recognizes that value in construction projects is neither unique nor static, but rather a multidimensional and context-dependent construct shaped by the perspectives of

[1] PhD Student, Civil and Environmental Engineering Department, INGECO research group, Universidad de los Andes, Bogotá, Colombia, d.rojasm@uniandes.edu.co, https://orcid.org/0000-0002-8425-9508
[2] Assistant Professor, Civil and Environmental Engineering Department, INGECO research group, Universidad de los Andes, Bogotá, Colombia, ne-garci@uniandes.edu.co, https://orcid.org/0000-0001-9053-0897
[3] Masters Student, Civil and Environmental Engineering Department, INGECO research group, Universidad de los Andes, Bogotá, Colombia, s.laral@uniandes.edu.co

multiple stakeholders In response, models such as the Value Analysis Model (VAM) and methodologies such as Target Value Design (TVD) have been proposed to make client value objectives explicit and to reduce gaps between desired, potential, and generated value (Giménez et al., 2020; Jacob et al., 2021). However, the effectiveness of these approaches is often constrained by the underlying organization of the design process itself, which remains dominated by sequential workflows, irreversible decisions, and limited opportunities for early value integration.

In parallel, generative design has emerged as a promising tool to support more efficient design processes aligned with Lean Design principles (Fosse & Ballard, 2016; Munthe-Kaas et al., 2015). Recent studies show that generative design can create value across different activities within the design stage by enabling the rapid generation and evaluation of multiple alternatives based on quantifiable parameters (Rojas Marinkelle et al., 2025). Through this capability, generative design offers the potential to explicitly capture client requirements and translate them into multidimensional design criteria. This raises an important question: how can generative design function as an enabling mechanism for the early integration of fragmented stakeholder value perceptions during the design stage of construction projects?

This gap is particularly relevant in projects where value perceptions are fragmented across disciplines and where time pressure reinforces sequential decision-making. While generative design can represent and evaluate value-related parameters, its role as a mechanism for converging diverse stakeholder value perceptions and enabling integrated value delivery has not yet been sufficiently explored.

To address this gap, the objective of this article is to analyze how generative design can be understood as an enabling mechanism for the early integration of value in construction projects. Drawing on a qualitative approach based on semi-structured interviews and the Gioia method (Corley & Gioia, 2004), the study conceptualizes value as a relational and multidimensional construct and examines how generative design may support the convergence of stakeholder value perceptions during the design stage. In doing so, the article positions generative design not merely as a technological tool, but as a potential reformer of the design process toward more integrated value delivery aligned with Lean principles.

POINTS OF DEPARTURE

VALUE ASSESSMENT AND LEAN DESIGN

Value assessment in construction projects has evolved toward approaches that capture and measure value beyond traditional cost estimates. Models such as the Value Analysis Model (VAM) translate stakeholder requirements into quantitative value indices and enable comparisons between desired, potential, and generated value, allowing the identification of value losses throughout the design and construction process (Giménez et al., 2020). From a Lean perspective, methodologies such as Target Value Design (TVD) reinforce this approach by establishing explicit value objectives from early project stages and promoting continuous interdisciplinary collaboration to align design decisions with client goals (Jacob et al., 2021).

These approaches are framed within Lean Design, which aims to maximize client value, reduce waste, and minimize rework through practices such as BIM, the Last Planner System, and Set-Based Design (Fosse & Ballard, 2016; Munthe-Kaas et al., 2015). However, in practice, design processes often remain organized in sequential, discipline-based workflows, limiting early value integration and continuous validation under strict time constraints.

GENERATIVE DESIGN AND THE INTEGRATION GAP

Within this context, generative design, understood as a computational approach that uses algorithms to generate and evaluate multiple design alternatives based on predefined objectives and constraints (Lee et al., 2023), has emerged as a tool aligned with Lean Design principles.

By enabling the systematic exploration of design spaces using quantifiable criteria within reduced time frames, generative design supports more informed and efficient design decision-making (Rojas Marinkelle et al., 2025). However, despite its technical potential, existing applications in the AEC industry remain fragmented and largely confined to specific disciplines or isolated project stages.

METHODOLOGY

This study adopted a qualitative, inductive research approach structured into three main stages: (1) development of semi-structured interviews, (2) purposive participant selection aimed at analytical generalization, and (3) analysis using the Gioia methodology (Corley & Gioia, 2004)

First, semi-structured interviews were designed based on benefits and barriers to generative design implementation previously identified in the literature, and on a value definition adopted from Gimenez et al. that was used consistently throughout the study (Giménez et al., 2020). The interview protocol aimed to explore participants' perceptions of value in construction projects and how these perceptions relate to design optimization practices and the use of generative design, as well as how existing organizational and technical barriers may constrain this relationship.

Each interview began by eliciting the participant's own understanding of value in construction projects, including how value is interpreted within their discipline and how optimization efforts are prioritized under time and resource constraints. This was followed by a brief contextualization of generative design and the value definition used in the study to establish a shared reference frame. Participants then responded to questions structured around three core thematic areas: (1) optimization of value generation according to their own definition of value and their understanding of clients' value, (2) perceived value attributes of generative design, such as its potential to support value creation, reduce rework, and improve coordination and decision-making during the design process, and (3) perceived barriers to the implementation of generative design in current construction practice, including recurring sources of rework and coordination issues. The semi-structured format allowed flexibility to probe emerging topics while ensuring consistency across interviews.

Second, participant selection followed a purposive sampling strategy, prioritizing professionals with direct experience in design and construction projects. A total of 15 participants were interviewed, representing a range of professional roles and disciplines, including architecture, structural engineering, electrical engineering, hydraulic engineering, BIM coordination, and project-related research roles. Participants had experience in housing and/or infrastructure projects, enabling the study to capture the interdisciplinary and socio-technical dynamics characteristic of the construction sector. Data collection continued until theoretical saturation was reached, as evidenced by the absence of new relevant themes in subsequent interviews. All interviews lasted approximately 45 minutes, were audio-recorded, and transcribed verbatim. Transcripts were reviewed to ensure transparency and fidelity to participants' original meanings.

The final stage of the methodology involved the application of the Gioia methodology (Corley & Gioia, 2004), which was selected due to its suitability for inductive theory building and its emphasis on capturing participants' lived experiences and interpretations while maintaining analytical rigor. This approach is particularly appropriate for exploring complex and ambiguous constructs such as value in generative design contexts. The analysis began with open coding to identify first-order concepts, grounded in verbatim quotes from the interview transcripts. Two independent codifiers conducted the coding process to enhance analytical rigor and reduce individual researcher bias. Coding and data management were supported using the qualitative analysis software Dedoose.

First-order codes were subsequently grouped into second-order themes based on conceptual similarities and their alignment with the main interview axes: perceptions and generation of value, and generative design value attributes for the implementation of generative design solutions in the construction industry. Finally, aggregate dimensions were developed by integrating the second-order themes, enabling the construction of a coherent data structure that supports theory development.

RESULTS

PARTICIPANT SELECTION

Among the participants, experience in coordination-related roles and structural design was predominant, with eight participants involved in coordination activities and six participants reporting experience in structural engineering. Experience in BIM-related roles and architecture was also significant, reported by four participants in BIM and three participants in architecture. Additionally, two participants had experience in hydraulic engineering, one participant in electrical engineering, and one participant was involved in research-related roles.

Several interviewees held responsibilities across two or more professional fields, reflecting the hybrid and interdisciplinary nature of contemporary design and construction practice. For example, some participants combined architectural design responsibilities with BIM coordination roles, allowing them to simultaneously engage with discipline-specific design decisions and cross-disciplinary coordination processes. This overlap enabled the exploration of interdisciplinary interactions and diverse value perceptions across design domains, which is particularly relevant for understanding value generation and coordination dynamics in complex construction projects.

RESULTS FROM INDUCTIVE CODING

First-order Codes

In the first stage of coding, 287 first-order codes were extracted from the interview transcripts. These codes were subsequently grouped into second-order codes, resulting in data fragments of varying lengths associated with specific themes. This process was conducted cautiously, preserving the original intent of each statement to ensure faithful categorization into second-order codes.

Second-order Codes

Sequential organization of the design process: Participants consistently described the design process as structured around a sequential, phase-based workflow, in which disciplines validate and deliver their outputs one after another (Gagnon et al., 2019). Within this arrangement, rigid phasing created strong dependencies between disciplines, making progress in one area contingent on the completion of previous stages and rendering many design decisions difficult to reverse once a phase had been completed. Notably, this sequential logic persisted even in projects where BIM tools were in use, as coordination practices continued to follow a discipline-by-discipline workflow rather than a concurrent or integrated process.

Time as a constraint on integration: Respondents emphasized that limited time frames significantly constrained opportunities for coordination and integration across disciplines. Participants reported insufficient time to jointly review information or evaluate multiple design alternatives, particularly during early stages. As a result, changes introduced at later phases were described as costly and disruptive, requiring substantial effort to accommodate within already defined design configurations.

Progressive degradation of design quality: The analysis further revealed that time pressure and sequential staging were associated with a gradual degradation of design quality

over the course of the project. Participants described situations in which quality considerations were subordinated to delivery deadlines, resulting in limited opportunities for optimization and delayed validation of design solutions. These conditions were reported as contributing to designs that met immediate delivery requirements but were perceived as insufficiently refined or fully coordinated.

Value as a multidimensional construct across stakeholders: Participants consistently described value not as a single or homogeneous concept, but as a multidimensional construct shaped by multiple criteria and stakeholder perspectives (Giménez et al., 2020). Respondents emphasized that design decisions were influenced by factors such as quality requirements, time constraints, regulatory compliance, resource availability, and project context, with each discipline and stakeholder prioritizing different aspects of value. As a result, value was experienced as being interpreted differently across actors, rather than as a shared or explicitly articulated objective during the design process.

Fragmentation of value perceptions in the design process: The analysis revealed that these multiple interpretations of value tended to remain fragmented throughout the design process (Erikshammar et al., 2010). Participants reported that each discipline often focused on optimizing what they perceived as valuable within their own scope of responsibility, with limited mechanisms to align or reconcile these perspectives across the project team. Consequently, design decisions reflected discipline-specific notions of value rather than an integrated or collectively negotiated understanding of what constituted value for the project as a whole.

Lack of explicit mechanisms for value measurement and validation: Participants further indicated that value was rarely measured, quantified, or explicitly validated during the design process (Forgues et al., 2008). Instead, value-related decisions were commonly based on assumptions, prior experience, or individual judgment, with limited use of formal criteria or metrics to assess whether design outcomes aligned with stakeholder expectations. This absence of explicit mechanisms made it difficult for participants to determine whether the evolving design effectively delivered the value anticipated by different stakeholders.

Generative design as an enabler of early integration and design exploration: In contrast to the sequential and time-constrained design practices described earlier, participants framed generative design as a mechanism that enables the early integration of multiple design variables and the systematic exploration of alternative solutions. Respondents emphasized the ability of generative approaches to evaluate multiple scenarios simultaneously, reducing the need for repetitive manual modeling and allowing design decisions to be informed by technical, economic, and contextual criteria from early project stages.

Generative design as a mechanism for improved and faster decision-making processes: Participants described generative design as supporting more transparent, objective, and faster decision-making processes by enabling systematic comparisons across multiple design alternatives within shorter time frames (Rojas Marinkelle et al., 2025). Rather than replacing expert judgment, generative tools were framed as augmenting it by providing structured, data-driven insights that allow designers to evaluate complex trade-offs more efficiently and to reach informed decisions earlier in the design process.

Generative design as driver of value creation across stakeholders: Finally, generative design was associated with the creation of value across multiple stakeholders. Participants highlighted improvements in design quality, time efficiency, and resource optimization, as well as the potential to align diverse stakeholder expectations by explicitly incorporating value-related criteria into the design process.

Table 1 presents representative interview excerpts illustrating how first-order concepts were associated with the second-order themes identified during the coding process.

Table 1: Representative interview quotes supporting first- and second-order concepts

Quote	First-Order Concept	Second-Order Theme
"First it has to be validated by architecture… then this information is passed on to another discipline."	Sequential validation and handoff between disciplines	Sequentiality of the design process
"Since there is not enough time to relate everything, everyone just keeps delivering their outputs… and it is not really possible to verify all the information."	Lack of time for cross-disciplinary coordination	Time as a constraint on integration
"Many times in design we were aware that, because of the rush to deliver, we delivered without doing a deeper review… not because you are a bad professional, but because you have deadlines."	Rushed delivery limiting design review	Progressive degradation of design quality
"When you generally have a client, they give you an idea of what they want… something very general… and when you propose a design, they may like it or they may not."	Limited understanding of client value expectations	Fragmentation of value perceptions in the design process
"We had to redo the entire design from scratch because they said they didn't like it that much."	Late client feedback triggering design rework	Lack of explicit mechanisms for value measurement and validation
"One person can evaluate many scenarios at the same time… what might take two weeks, a program can do in two hours."	Simultaneous evaluation of multiple design scenarios	Generative design – early integration
"I would have multiple options with different variables that are going to allow me to make a better decision."	Multiple design alternatives supporting decision making	Generative design – decision making
"An automated pre-feasibility process that includes all disciplines."	Early-stage interdisciplinary integration	Generative design – value creation

Aggregate Dimensions

Time as a structural constraint on integration and design: Under time pressure, design activities were described as predominantly sequential, with strong interdependencies between disciplines and rigid phase boundaries. This configuration reinforces discipline-by-discipline workflows and hierarchical validation practices, limiting opportunities for integration and coordination across the project team. Consequently, the design process was described as oriented toward managing time rather than enabling concurrent or collaborative activities.

Fragmentation of value understanding and validation under time pressure: Participants associated time pressure and sequential staging with shifts in how design quality was addressed over the project. Quality considerations were often deprioritized in favor of meeting delivery deadlines, alongside limited opportunities for optimization and late-stage validation of design solutions. As a result, outcomes met immediate requirements but were perceived as insufficiently refined or coordinated across disciplines.

Progressive degradation of design quality driven by temporal constraints: Participants associated time pressure and sequential staging with shifts in how design quality was addressed over the project. Quality considerations were often deprioritized in favor of meeting delivery deadlines, alongside limited opportunities for optimization and late-stage validation. As a result, outcomes met immediate requirements but were perceived as insufficiently refined or coordinated across disciplines.

Generative design as a value network integrator in the design stage: Participants described generative design as enabling simultaneous evaluation of multiple design alternatives based on quantifiable criteria, reducing reliance on sequential workflows and enabling early cross-disciplinary integration. They further indicated that incorporating value-related parameters into generative processes allowed diverse stakeholder expectations to be considered early, rather than in isolation by each discipline. These conditions were associated with more informed, transparent decision-making and greater alignment of fragmented value perceptions across the project team.

Figure 1 presents the data structure resulting from the Gioia methodology, illustrating the analytical progression from second-order themes to three aggregate dimensions.

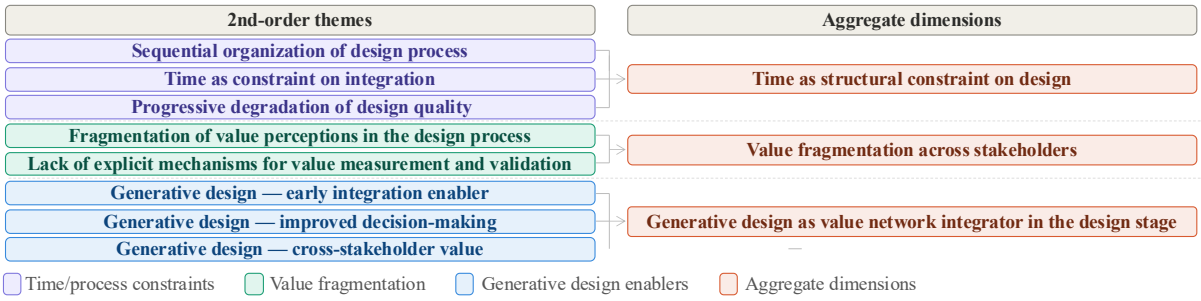

Figure 1: Gioia data structure

DISCUSSION

VALUE AS A MULTIDIMENSIONAL AND RELATIONAL CONSTRUCT

The findings indicate that value in construction projects is neither interpreted nor operationalized as a single, shared construct. Giménez et al. (2020) argue that value depends on each stakeholder, is shaped by context, and evolves over time. Participants reaffirmed this, indicating that value is interpreted within discipline-specific frames shaped by technical responsibilities, experience, project context, regulatory constraints, constructability, and resource availability. Despite this fragmentation, a common orientation toward fulfilling client needs was evident, with the client ultimately determining whether designers' interpretations align with project objectives.

Clients play a central role by approving solutions, redefining value, or aligning stakeholder interpretations. Participants described rework arising from limited understanding of client value, often due to broadly defined scopes or late feedback. This process revealed the absence of explicit mechanisms for value validation and measurement during design. Views on validation varied, including external review, cost-focused assessment, or alignment with initial client requirements.

Accordingly, project value emerges as a multidimensional construct defined by the perspectives of multiple clients within an overarching view of the final client. This construct is neither unique nor shared; rather, it emerges from a network of value interpretations held by different project actors and their interactions. From this perspective, stakeholder value can be conceptualized as a representation within a probabilistic latent space. Within such a space, value generation in construction projects can be understood through a finite and reduced set of variables representing an original feature space (Ghojogh et al., 2022), which abstracts a reality influenced by a potentially infinite number of variables. Moreover, each point z represents a configuration of multiple latent characteristics within the probabilistic latent space (Hofmann, 2001). While the latent representation z captures a shared underlying reality, the conditional distribution over perceived value $p(x \mid z, s)$ varies across stakeholders (s), reflecting differences in how latent factors are interpreted and weighted.

SEQUENTIAL DESIGN AS A MECHANISM TO MATERIALIZE FRAGMENTED VALUE

Despite diverse value perceptions among stakeholders, the design process seeks consensus aligned with client interests. Participants described sequential, hierarchical validation across disciplines. Through these dynamics, a value network emerges, anchored in the initial client's perception: each designer becomes a client of the project requirements while also relying on design information shaped by other designers' interpretations of value.

Even with the adoption of integration methodologies such as BIM, participants reported high rework linked to sequential, waterfall-like design processes. As a result, the value network often collapses into a value chain, with architecture conditioning downstream outcomes. One participant described a clear hierarchy, progressing from architecture to structures, gravity-based systems, pressurized systems, and finally electrical systems.

This sequencing process is driven by the client and by those requirements most strongly associated with specific disciplines, depending on how the client interprets the latent space of variables considered relevant for achieving project objectives. These disciplines gain priority within the design hierarchy, as they are perceived to have the greatest impact on client value. For this reason, multiple interviewees indicated that in residential and vertical infrastructure projects, architecture tends to delimit other disciplines, whereas in road infrastructure projects this role may be assumed by geometric design.

However, other disciplines, even when perceived as having a lower direct impact on cost, retain the capacity to modify previously defined architectural or structural decisions. Their contributions, however, are typically incorporated at later stages, once key design parameters have already been fixed. One participant expressed dissatisfaction by noting that electrical system design could require larger equipment, thereby necessitating changes in architecture and, consequently, in the entire disciplinary sequence. This illustrates how waterfall design generates value disintegration, whereby the progressive narrowing of the design space leads to a sequential organization of the value each designer can contribute.

Finally, the study also revealed that sequential design functions as a mechanism for reducing complexity in articulating a fragmented value network by concentrating decisions within the disciplines perceived by the client as most relevant. However, this sequential design, combined with the lack of mechanisms to reinforce early capture of client requirements and the absence of tools such as VAM to validate value as it evolves over time, resulted in rework triggered by late client feedback on design solutions.

TIME AS A STRUCTURAL CONSTRAINT REINFORCING SEQUENTIALITY AND UNDERMINING VALUE DELIVERY

For this reason, time begins to play a fundamental role in client value perception, as several participants highlighted the importance of shorter design cycles, arguing that these would allow

for more accurate or better design outcomes. This aligns with the notion that shorter design iterations at earlier stages enable client feedback and facilitate consensus-building around value perceptions among different stakeholders through the validation of design outputs at each iteration. At this point, the production time required for each design task begins to shape the sequential organization of design activities. Within the value network, designers must interact and exchange information that reflects their respective value perceptions, which then become prerequisites for subsequent designers. This exchange of information occurs only after a given design has been produced at a specific time. Consequently, even when integration practices are implemented and information is centralized through methodologies such as BIM, the time required to develop each design inherently defines clear precedences between disciplines.

As a result, the time allocated to the design stage also begins to influence the nature of design decision-making. From a more disaggregated perspective, the total time assigned to the design phase must be distributed to complete all required design deliverables within a fixed time horizon. Under these conditions, stakeholders involved in the design stage experience pressure from fixed deadlines and based on their professional experience with design production times, make judgments about what can realistically be designed within the available time window. This creates a trade-off for each designer, where the available time constrains how their perception of value can be translated into design solutions. Even when short design iterations are theoretically possible or when effective value integration has been achieved within the stakeholder value network, the stage-based structure of construction projects may still prevent the delivery of the value desired by the client.

Several participants reported that, when faced with imminent deadlines, they were forced to deliver designs with a level of quality below what they considered desirable. While these designs were described as functional, participants acknowledged that they could have been further optimized if more time had been available. In this context, one participant expressed dissatisfaction with the delivery of oversized designs or designs lacking thorough quality review—not as a reflection of poor professional practice, but as a consequence of meeting imposed delivery schedules. Consequently, time can be understood as a detractor from the delivery of potential value and even desired value during the design stage (Giménez et al., 2020)

GENERATIVE DESIGN AS AN ENABLER OF EARLY INTEGRATION OF VALUE NETWORKS

Participants recognized generative design as a tool that can facilitate the delivery of potential value in construction projects by enabling early-stage integration. Interviewees highlighted the ability of generative design to analyze multiple disciplines simultaneously or within significantly reduced time windows. Through this capability, generative design emerges as a differentiating factor by shortening design iteration cycles or, in some cases, eliminating them altogether

This, in turn, enables a more collaborative decision-making process. Beyond reducing design time, generative design facilitates disciplinary integration and acts as an articulator of the project's value network. Through simultaneous or near-simultaneous design generation, designers participating in the value network gain the ability to align their understanding of the latent design space using quantified variables. This enables members of the value network to construct a shared value representation, in contrast to the fragmented value interpretations characteristic of waterfall-based design processes. This is made possible by the capacity of generative design to capture and quantify parameters that each designer—directly or indirectly—perceives as contributors to client value.

As a result, participants associated generative design with benefits such as increased organizational competitiveness, more efficient and optimized designs, and stronger alignment with their value perceptions. This value-alignment process is further supported by generative

design's ability to generate multiple design alternatives. Such capability facilitates decision-making by calibrating relevant parameters across alternatives, enabling consensus-building around the aspects that generate value in the final product and ensuring alignment with client expectations. In this sense, generative design creates synergies with models such as the VAM (Giménez et al., 2020), as it allows the quantification and validation of value across multiple alternatives and their comparison with potential and desired client value. This process can be carried out in subsequent design stages, capturing changes in value perception over time.

For these reasons, within this study, generative design is positioned not merely as an aggregated dimension, but as a proposed mechanism to reform the design process itself, serving as a tool for integrated value delivery within project value networks.

CONCLUSIONS

This study examined how generative design may contribute to integrated value delivery during the design stage of construction projects. Based on interviews analyzed using the Gioia methodology, the findings show that design work is commonly organized through sequential, phase-based workflows in which disciplines deliver and validate outputs one after another. Participants reported that this organization persists even when BIM tools are used, as coordination practices remain largely discipline-by-discipline rather than concurrent. Across accounts, limited time frames constrained opportunities for early coordination, joint review, and exploration of alternatives. As a result, changes introduced in later phases were described as disruptive and costly, and quality-related considerations were often subordinated to meeting delivery deadlines, contributing to designs perceived as insufficiently refined or fully coordinated.

The findings also indicate that value is understood as multidimensional and interpreted differently across stakeholders and disciplines, shaped by project context, regulatory constraints, constructability considerations, and resource availability. However, these value interpretations frequently remained fragmented during the design process, with limited mechanisms to align perspectives across the project team. Participants further noted that value was rarely measured or explicitly validated through formal criteria during design. Instead, decisions were commonly guided by assumptions, experience, and professional judgment, limiting the team's ability to assess whether evolving design solutions aligned with stakeholder expectations.

In this context, participants associated generative design with three contributions to design-stage value delivery. First, they described generative design as supporting earlier integration by enabling the simultaneous consideration of multiple design variables and by facilitating systematic exploration of alternatives within reduced time windows. Second, they framed generative approaches as supporting faster and more transparent decision-making by enabling structured comparisons across multiple alternatives using quantifiable criteria. Third, participants linked these capabilities to the potential to improve alignment across stakeholder expectations by making trade-offs and performance differences across alternatives more explicit. Taken together, these findings suggest that generative design is perceived not only as a tool for efficiency, but as an approach that may help teams move from discipline-centered optimization toward earlier cross-disciplinary alignment around value-related criteria.

This study is limited by the scope and context of the participant sample, which primarily reflects professional experience in Colombia. Future research should test these relationships in additional project and delivery contexts and examine the organizational conditions under which generative design can meaningfully support value integration. In particular, further work is needed to understand how value criteria are selected, negotiated, and validated across stakeholders, and how generative design workflows can be embedded into routine coordination and decision-making practices to reduce late-stage changes and support more consistent delivery of design quality and stakeholder value.

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