# Integrating the End-User's Voice in the Target Value Setting Process During the Project Definition Phase: Challenges and Potential Solutions

by

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**Intégration de la voix de l'utilisateur final dans le processus de définition de la valeur cible lors de la phase de définition du projet : défis et solutions potentielles**

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## RÉSUMÉ

L'industrie de la construction, un des plus grands secteurs économiques mondiaux, continue de faire face à des défis tels que l'inefficacité, la fragmentation et le manque de transparence, entraînant des dépassements de coûts, des retards et une faible productivité. Pour remédier à ces problèmes, des méthodologies issues de la production manufacturière, notamment la Livraison à la Valeur Cible (TVD), ont été adaptées pour promouvoir la collaboration et la création de valeur pour les parties prenantes. Cependant, malgré son potentiel, l'adoption de la TVD reste limitée en raison de défis comme la définition claire de la valeur dans des projets complexes.

Cette thèse explore l'application de la TVD dans le secteur de la construction, en mettant l'accent sur la définition de la valeur grâce à la participation des utilisateurs lors des premières phases de projet. La méthodologie de recherche constructive choisie pour cette étude se base sur deux études de cas au Québec : un projet d'expansion de campus et un projet de modernisation de lycée, qui ont intégré des approches et outils Lean, pour favoriser la collaboration et la création de valeur.

Le chercheur a recueilli des données par analyse documentaire, observation d'ateliers et entrevues semi-structurés avec des parties prenantes, incluant architectes, ingénieurs, utilisateurs et représentants gouvernementaux. Des techniques qualitatives ont permis d'identifier comment la conception participative et les méthodologies Lean ont soutenu la prise de décision et la définition de la valeur. Les études de cas ont été complétées par des entrevues d'experts pour enrichir l'analyse des défis pratiques et des avantages de la mise en œuvre de la TVD.

Les résultats de cette recherche démontrent l'importance de l'engagement précoce des parties prenantes, particulièrement des utilisateurs finaux, pour aligner les résultats du projet avec les exigences fonctionnelles et les valeurs des parties prenantes. Cependant, des obstacles persistent, tels que la difficulté à définir la valeur, à gérer les attentes et à coordonner les équipes multidisciplinaires. Cette thèse propose des recommandations pour renforcer l'intégration des ateliers participatifs et des outils d'inclusion des utilisateurs, permettant une livraison de projet plus efficace et alignée sur les valeurs.

**Mots-clés** : livraison à la valeur cible, méthodologies lean, processus de conception intégré, usager final, définition de la valeur

**Integrating the end-user's voice in the target value setting process during the project definition phase: challenges and potential solutions**

Brenda Cristine DA SILVA LAURINDO

## ABSTRACT

The construction industry, one of the largest sectors in the global economy, continues to face challenges such as inefficiency, fragmentation, and lack of transparency, leading to cost overruns, delays, and low productivity. To address these issues, methodologies from manufacturing, particularly Target Value Delivery (TVD), have been adapted to promote collaboration and value creation for stakeholders. However, despite its potential, TVD adoption remains limited due to challenges such as the clear definition of value in complex projects.

This thesis explores the application of TVD in the construction sector, focusing on value definition through user participation during the initial project phases. The chosen constructive research methodology is based on two case studies in Quebec: a campus expansion project and a high school modernization project, both incorporating Lean approaches and tools to foster collaboration and value creation.

The researcher collected data through document analysis, workshop observations, and semi-structured interviews with project stakeholders, including architects, engineers, users, and government representatives. Qualitative techniques helped identify how participatory design and Lean methodologies supported decision-making and value definition. The case studies were supplemented by expert interviews to enrich the analysis of the practical challenges and benefits of TVD implementation.

The findings highlight the importance of early stakeholder engagement, particularly end-user participation, to align project outcomes with functional requirements and stakeholder values. However, challenges persist, such as difficulty in defining value, managing expectations, and coordinating multidisciplinary teams. This thesis proposes recommendations to strengthen the integration of participatory workshops and user inclusion tools, enabling more effective and value-aligned project delivery.
This thesis contributes to value-focused construction practices by proposing strategies for enhancing the use of participatory design and Lean methodologies in construction projects. Recommendations include the structured use of participatory design workshops and tools that support improved user inclusion in decision-making processes, leading to more effective and value-aligned project delivery.

**Keywords**: target value delivery, lean methodologies, integrated design process, end user, value setting

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| | |
|---|---|
| 3P | Production, Preparation and Processes |
| AEC | Architectural Engineering and Construction |
| BIM | Building Information Modeling |
| CIC | Construction Industry Council |
| DQI | Design Quality Indicator |
| GRIDD | Groupe de recherche en intégration et développement durable en environnement bâti |
| IDP | Integrated Design Process |
| IPD | Integrated Project Delivery |
| LLD | Lean Led Design |
| LPDS | Lean Production Delivery System |
| SQI | Société Québécoise des Infrastructures |
| TC | Target Costing |
| TFV | Transformation, Flow, and Value |
| TVD | Target Value Delivery |

# INTRODUCTION

The construction industry accounts for 13 percent of the world's GDP, moving $10 trillion annually according to McKinsey Global Institute (2017). An industry with such a significant influence on the world economy requires more innovative and productive processes, especially when analyzing the impact of this industry to the environment and society. The construction industry is currently characterized by great waste of labor, materials, and time, lack of collaboration and transparency, and extremely low profits (Mischke, Stokvis, & Vermeltfoort, 2024; Goolsbee & Syverson, 2023; McKinsey Global Institute, 2017; World Economic Forum, 2016; Changali, Mohammad, & van Nieuwland, 2015).

In an effort to address these challenges and enhance competitiveness , the construction industry has turned to methodologies from the manufacturing sector. One of the methodologies that emerged in manufacturing and was adapted to construction is the Target Costing (TC) as mentioned by Feil, Yook, & Kim (2004), which seeks to lower the costs of the final product by taking it as an input in the design process. The TC methodology has undergone modifications and adaptations over the years, including the incorporation of Value Engineering, which aims to define the price based on what the market is willing to pay. In addition, there were changes to the TC methodology with the incorporation of Lean concepts, which led to the development of Target Value Design, more accepted nowadays as Target Value Delivery (Rybkowski, Arroyo, & Parrish, 2022).

The Target Value Delivery (TVD) methodology came as an answer to the problems of cost and profit, as well as to the issues of transparency and collaboration in the construction market. The essential fundamentals of the methodology, besides the inherited TC approach of cost as an input, are collaboration and transparency regarding the amounts available and necessary for project execution. Its main objective, however, is the realization of projects that respond to the client's and end user's values without exceeding the cost limitations.

Although the TVD approach and its various adaptations have been explored by numerous researchers, information on its adoption remains limited. Despite the growing emphasis on value delivery in construction projects in recent years, the number of publications addressing the practical implementation of TVD is still relatively scarce, as highlighted by Rybkowski et al. (2022). Despite the documented benefits, only a small number of companies seen to have implemented TVD in select projects globally, largely due to the significant challenges associated with its implementation.

Among the challenges encountered in the application of the methodology are those related to the construction environment, still marked by high fragmentation, mistrust and lack of transparency between teams acting in the project (Malvik, Kalsaas, Shabani, & Sandvik, 2021a; Musa & Pasquire, 2020; Tillmann, Do, & Ballard, 2017).

Difficulties related to the restricted vision and the search for short-term benefits. The TVD, as most of the participative approaches, requires greater dedication in the early stages of the project, unlike the traditional (Design – Bid - Built) methodologies whose greater effort is identified in the later phases. Finally, the difficulty that represents one of the most critical factors: defining the value for both the customer and the end user, as well as defining the conditions of satisfaction for the stakeholders (Rybkowski et al., 2022; Malvik, Johansen, Torp, & Olsson, 2021 b; Miron, Kaushik, & Koskela, 2015).

The study to which this thesis is dedicated is intrinsically associated with the applications of the TVD method in the construction industry. Precisely the main question driving this research is: How can value be clearly defined in the early stages of construction projects?

The main objective of this study is to develop a structured process for setting project target values, specifically focusing on defining clear steps for the inclusion of end-users and the definition of value during the project’s early stages.

This research aims to address two critical gaps: the first being the industry-wide challenge regarding the insufficient involvement of end-users in the early phases of construction projects, and the second being the existing literature gap, which lacks comprehensive, structured guidance on how to effectively integrate end-users to enhance value creation. By addressing these gaps, this study seeks to contribute to the alignment of project goals with stakeholder needs from the outset, fostering better project outcomes.

To address the problem and achieve this thesis main objective, this thesis will be focusing on the following sub-objectives:

- Identify the challenges and benefits associated with the use of participatory design in Quebec.
- Verify the benefits and problems of engaging users in construction projects during the early phases.
- Identify the tools that can support the adoption of participatory approaches and user inclusion for effective target value setting.

In the first chapter, a literature review is conducted to explore the fundamentals and tools underlying the concept of value in the construction industry as well as their synergies with emerging methodologies. Additionally, this chapter analyzes how these tools foster collaboration and enhance the decision-making process throughout construction projects.

The second chapter describes the methodology used to achieve the research objectives. It also presents the reasons for the selection of the case that will be explored, the techniques used for data collection, as well as the steps followed, and the measures taken to ensure the reliability and validity of the research.

The third chapter details the first case study, which focuses on the design of a university campus expansion. This project utilized the Integrated Design Process (IDP) methodology and the Kaizen approach, to gather user input. The second case study, the expansion of a high

school is presented in the fourth chapter. Similarly to the first case, IDP was used, but in combination with Lean-Led Design to capture user needs.

The results obtained from both cases as well as the exploration of the Target Value Delivery process, made by interviewing experts is presented in chapter 5. The discussion of the results obtained is made in the sixth chapter. It provides the benefits and problems identified in the value creation and decision-making with the use of TVD, as well as the critical analysis of the different applications of the methodology and possible improvements.

The final chapter brings the conclusion of this research work, providing information and recommendations for future research on the subject.

# CHAPTER 1

# LITERATURE REVIEW

This chapter provides a contextualization of the research problem by exploring the current state of the construction industry in the first section. Following this, previous research will be examined across the next seven sections, analyzing existing project delivery approaches and delving deeper into the concept of value throughout the project definition process. This structure aims to clarify the specific challenges faced by the industry and to assess how existing methods approach the concept of value, providing sufficient information for the understanding of this research data analysis and discussion.

## 1.1 Construction reality

The current reality of the construction industry is of low productivity (McKinsey Global Institute, 2017), projects delivered at a higher cost than estimated and with substantial delays. These issues are combined with the speed at which complex construction projects (hospitals and schools) become obsolete and unresponsive to the needs of the public they are intended to support.

The problems mentioned above led to the study of the different methods used both in the contracting and planning side, in the construction industry today and the pursuit of practical solutions that can drive the industry's development. In this section the different characteristics of the construction industry that motivate undertaking this thesis are explored.

Among the characteristics of the sector that contribute to the obsolescence of the mentioned projects is the linear nature of the construction project management process, most of them adapted from the manufacturing sector mass production techniques. The most used process nowadays is the briefing process, originated at the United Kingdom market and the project management approach from the United States market.

The briefing process existed from the 1950s, but had its major success due to the Egan (1998) and Latham (1994) reports. The reports in question offered an analysis of the construction industry in the UK and proposed the briefing process as an essential tool for the industry to arise to the challenge of the modernization and better productivity.

To account for the industry needs the Briefing process also evolved. In the 1970s it was mainly a linear process where the briefing (definition of the project) should be final before any design could be made. This perception changed thought the years and nowadays accounts less for details and more for the articulation between client and design team.

As described by Alastair & Worthington (2001) the briefing process is an evolutionary process in which the organization will understand its needs and resources while combining it with its objectives and mission to formulate and solve a problem. In short, it's the process of refining the client needs to achieve a solution.

In contrast, many project management approaches adapted from the manufacturing sector are characterized by a strong focus on scope, cost, schedule, and risk management. These approaches aim to transform client needs into structured requirements and develop detailed execution plans to efficiently deliver the final product. However, this rigid focus on efficiency often overlooks the complexity and dynamic nature of construction projects, leading to challenges in delivering projects that meet broader stakeholder needs.

Lean approaches, particularly in the construction sector, offer an alternative to these traditional methods by focusing on waste elimination and enhancing project value. Koskela's Transformation, Flow, and Value (TFV) theory (Koskela, 2000) is an example of a Lean approach centered on the entire production process, including the supply chain. Other Lean methodologies, such as the Lean-Led Design approach, focus on the end user, ensuring that projects meet their needs more effectively.

Among the recognized methodologies is the Lean Project Delivery System (LPDS). LPDS is an integrated approach to project delivery that emphasizes maximizing value and minimizing waste throughout the project life cycle (Ballard, 2008).

Despite the shared goal of addressing project needs, the various approaches discussed often cater to different stakeholders, which can pose challenges in complex projects.

## 1.2 The Lean Project Delivery System

Developed within the Lean Construction paradigm, the Lean Project Delivery System promotes collaboration, early stakeholder involvement, and continuous improvement to enhance project outcomes. At its core, LPDS is structured to integrate various project phases through constant feedback loops (See Figure 1.1), enabling learning and adaptation throughout the project lifecycle. This dynamic approach is crucial for delivering projects that not only meet customer expectations but also improve efficiency and reduce waste.

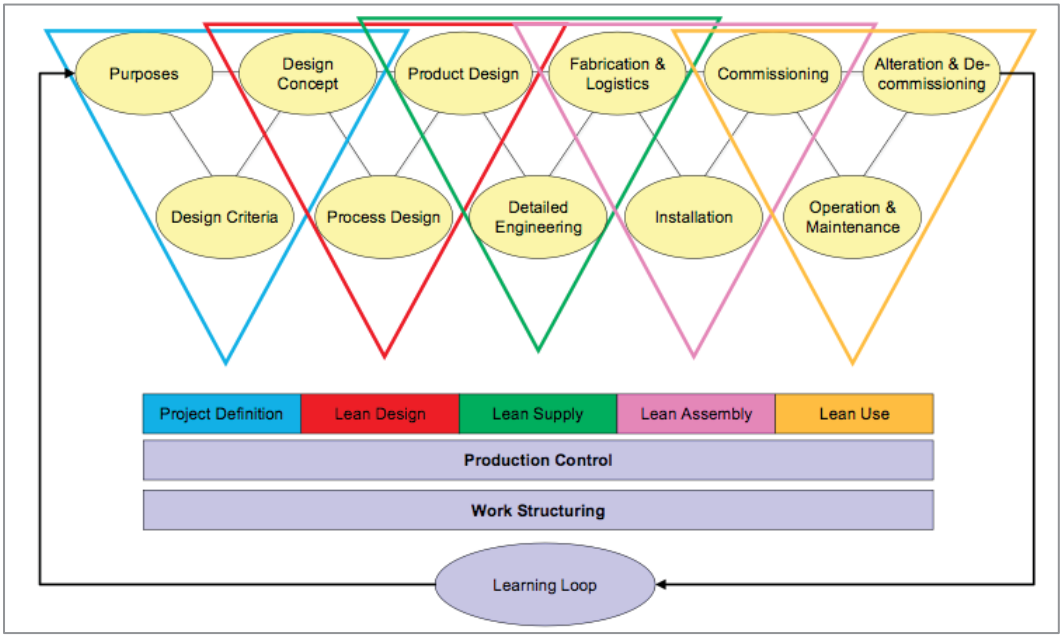


Figure 1.1 The Lean Project Delivery System
Taken from Ballard (2008, p. 5)

The LPDS begins with the **Project Definition** phase, where early collaboration with stakeholders plays a central role in identifying the project's essential needs and values. This stage is critical for establishing the project's design criteria, aligning stakeholder objectives with realistic deliverable outcomes. By focusing on this alignment early, the project's scope, budget, and time constraints are well-defined before moving into the design phase. A distinctive feature of this phase is the ongoing dialogue between the project team and the client, allowing both parties to refine initial expectations and transform them into practical and achievable goals (Ballard, 2008). The early involvement of stakeholders helps to ensure that all project participants are on the same page, minimizing the risk of future misunderstandings or the need for costly revisions.

Once the project's definition is established, LPDS transitions into the **Lean Design** phase, which emphasizes the simultaneous development of both the facility and its operational processes. Key tools such as Set-Based Design and Target Costing are employed to guide the design process, balancing the need for innovation with the necessity to meet cost and performance constraints. This phase encourages creative solutions while ensuring that the final design aligns with the project's defined value and operational goals. It is during this phase that LPDS fosters collaboration across disciplines, ensuring that design decisions are informed by a clear understanding of both cost implications and construction feasibility.

Following Lean Design, the system moves into the **Lean Supply** phase, where detailed engineering, fabrication, and logistics are coordinated. This phase translates the design into actionable plans for construction and handles the procurement of materials. The use of collaborative tools, such as 3D modeling, is essential here, as it enables designers, contractors, and fabricators to work in unison, ensuring that any potential issues are identified and addressed before they impact the construction process. This collaborative effort reduces inefficiencies and enhances the overall quality of the project.

In the **Lean Assembly** phase, the focus shifts to the physical construction and installation of the project's components. Just-In-Time delivery methods are employed to minimize waste and

ensure that materials are delivered precisely when needed, avoiding excess inventories and improving workflow. Coordination is key in this phase, as it ensures the smooth integration of all project elements, from the timely arrival of materials to the efficient execution of construction tasks. This phase underscores LPDS's commitment to optimizing resource use and streamlining construction processes to achieve better outcomes.

Throughout all phases of the LPDS, the system consistently applies its core principles, particularly the focus on **value generation**. LPDS views the construction process not just as a means of completing a project, but as an opportunity to maximize value for the client. This is achieved by emphasizing early and ongoing collaboration, ensuring that all decisions align with the customer's goals. Additionally, LPDS utilizes pull-based production techniques to control the flow of materials and information. This ensures that resources are only used when necessary, reducing the risks of overproduction, delays, and other inefficiencies (Ballard & Howell, 2003).

Despite the emphasis on value generation, a discrepancy is observed in how value is understood and defined in construction projects. This discrepancy arises from the perceived assumption in many existing methodologies and processes that professionals involved in such projects can effectively interpret user needs. Although efforts are made to capture these needs, the subjective nature of the concept of value often prevents these efforts from achieving their intended outcomes. This highlights the necessity for a more structured approach to capturing users' real needs and defining value in a way that aligns with their expectations.

## 1.3 Project definition

As seen in the previous section, the project definition phase is the first stage to be carried out in the entire project life cycle (Ballard & Zabelle, 2000; Chbaly & Brunet, 2022), it is also highlighted as the most important and critical stage in the project life cycle (Serugga, Kagioglou, & Tzortzopoulos, 2020; Yussef, Gibson Jr, El Asmar, & Ramsey, 2020).

Its significance comes from the fact that decisions that are essential to the success of the project are made at this stage and that it is possible to influence the following stages without major costs being incurred (See Figure 1.2).

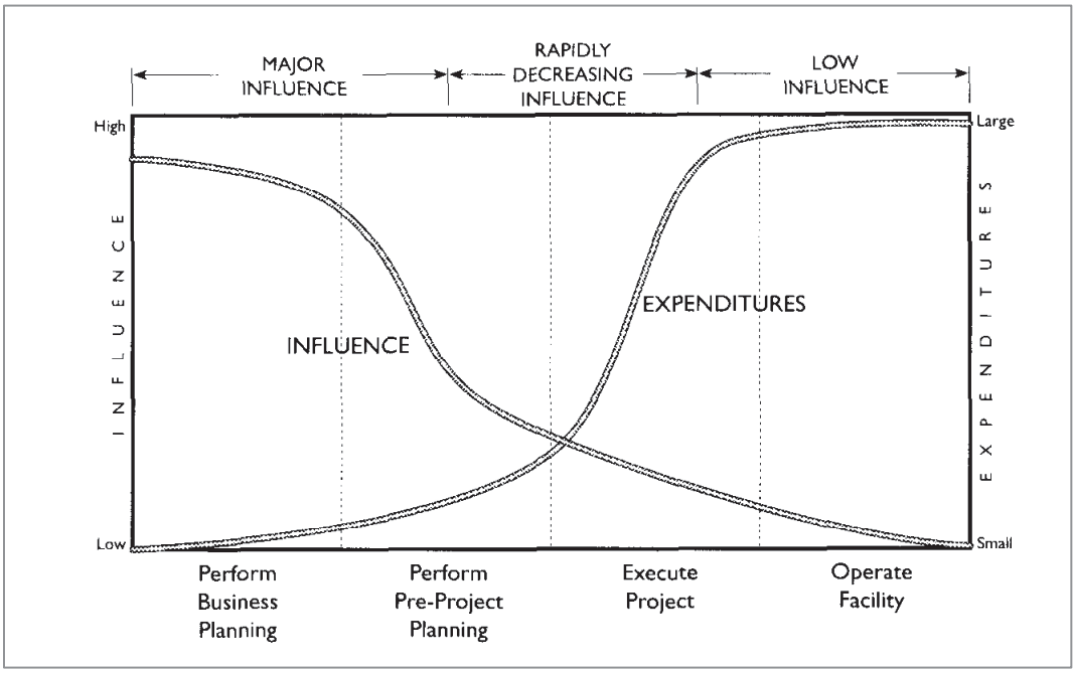


Figure 1.2 Influence and cost evolution during construction project life cycle
Taken from The Construction Industry Institute (1995, p. 6)

The key phases that constitute an effective project definition differ according to the authors and the approaches employed. Emmitt, Sander, & Christoffersen (2005) identify this as the phase in which decisions are made regarding value, design, procurement, time and budget. Ballard (2008) and Ballard & Zabelle (2000) define it as a process of aligning ends, means and constraints, to define the purpose for the stakeholders and focus efforts on creating a fit-for-purpose and fit-for-use design.

Finally Ballard & Zabelle (2000) also detail the three stages of the project definition process presented in the LPDS, mentioning the need for the movement through the purpose, criteria and concept modules to be iterative, later on Whelton & Ballard (2002) present an adaptation of the project definition stage considering the iterative process (See Figure 1.3), that could help the project purpose refinement.

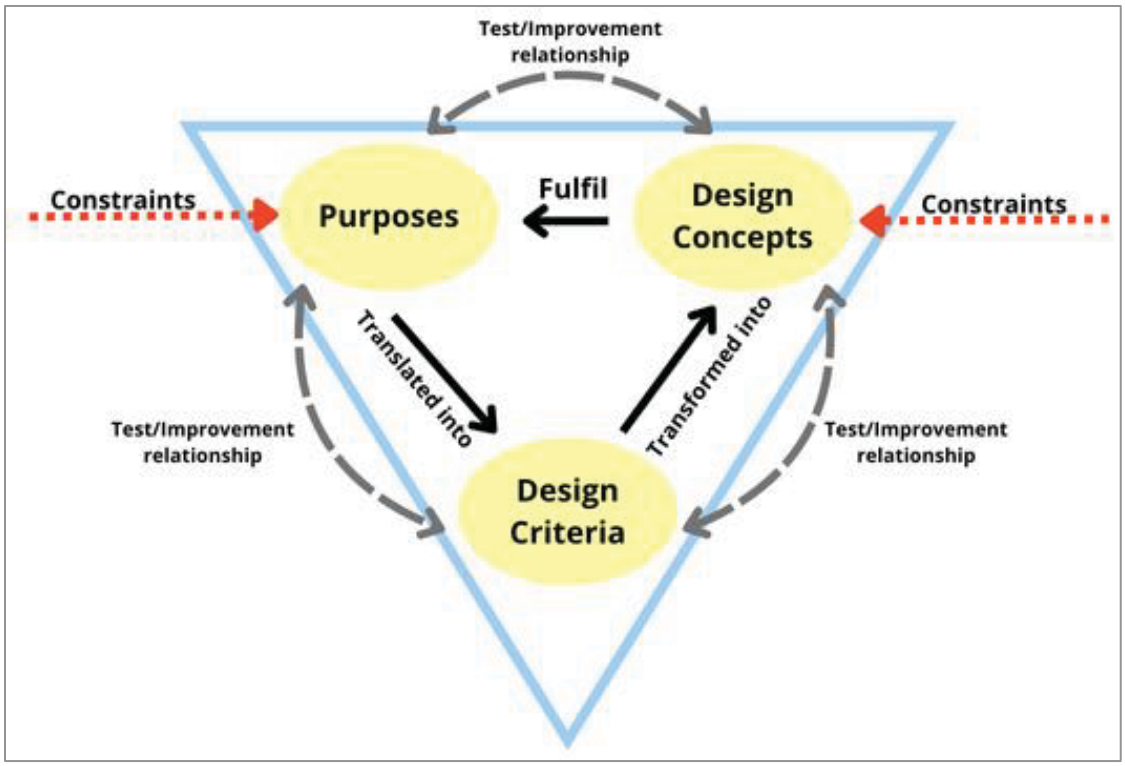


Figure 1.3 Project Definition Learning Model
Adapted from Whelton & Ballard (2002, p. 10)

The following table (Table 1.1) provides some of the project definition phases found in the literature, as well as the principles that base the approaches. Each of the project definition phases sequences presented is based to some extent in lean concepts, whose focus is the reduction of waste, leading to a reduction in rework and reducing the possibility of cost and time overruns.

However, despite the recognition by researchers and the Architectural, Engineering and Construction (AEC) professionals of the importance of this step, most projects still neglect it, especially if the traditional construction approach is taken.

Table 1.1 Project definition phases and principles found in the literature

| **Authors** | **The Project definition phase** | **Principles** |
|---|---|---|
| Chbaly (2021)<br>Chbaly & Brunet (2023)<br>Chbaly, Forgues, & Ben Rajeb (2023) | 1. Identification of client needs<br>2. Definition of a functional and technical program (project requirements)<br>3. First architectural concept (solution provided) | Lean Led Design<br>Value for End user<br>End user -driven |
| Emmitt et al. (2005) | Decisions about value, design, cost, time and procurement methods. | Briefing Process+ Lean Philosophy |
| Ballard (2008)<br>Ballard & Zabelle (2000) | 1. Determining purposes (stakeholder needs and values)<br>2. Translating those purposes into criteria for both product and process design;<br>3. Generating design concepts against which requirements, criteria and constraints can be tested and developed". | Fit for purpose and<br>Fit for use<br>Value-driven |
| The Construction Industry Institute (1995); | 1. Define project objectives and priorities.<br>2. Cost estimation<br>3. Risk analysis<br>4. Developing alternatives<br>5. Defining future obligations | owner-driven process |

Chbaly (2021) points out that the time pressure on projects leads to limited time devoted to exploring the client's needs, which leads to an incomplete project definition. This problem is even more discriminating when it comes to complex projects. Other issues related to project definition are presented in the Table 1.2.

Table 1.2 Problems in project definition encountered in the literature

| **Authors** | **Project definition problems** |
|---|---|
| Ballard (2008) | Difficulty in linking purposes and values,<br>Difficulty in linking values and engineering specifications and design criteria.<br>Different client types have different purposes |
| Chbaly & Brunet (2023) | Difficulty in defining purpose on projects where the environment is uncertain and complex.<br>Poor or incomplete project definition (changes in final stages of the project lifecycle, extra costs, and schedule overruns) |
| The Construction Industry Institute, (1995) | Lack of time allocated for project definition.<br>Lack of communication during design and execution |
| Chbaly (2021) | Needs capturing made in a hurry, without the participation of key client stakeholders.<br>Biased translation of needs<br>Pressure for project advances reduce reflection time on client requirements |

## 1.4 Value definition

As a result of the need for more sustainable and better-quality projects, the Construction Industry Council (CIC) has created a value agenda as part of their Design Quality Indicator (DQI) program. The UK agenda focus on putting stakeholders at the center of the definition of what a building should be, in addition to the considerations of functional and financial performances. In this context, building designs must consider the relationship between end users and the development (Thomson, Austin, Mills, & Wright, 2013). Since then, the concept of value has been increasingly present in the construction sector.

The concept of value has been used in different fields (Khalifa, 2004). The definition of what it represents and its importance in the context of product design has been the subject of exploration and development for several years, in fact the concept appears in the book that is considered one of the first to cover modern economics, written by Marshall (1890). Although discussed for many years and explored fore many authors (see Table 1.3), the concept of value is unclear. The concept of value is complex and multifaceted, as pointed out by Sánchez-Fernández & Iniesta-Bonillo (2007). The characteristics of it make it difficult to clearly define what it represents. Consequently the discussion of how to maximize value becomes challenging (Drevland & Lohne, 2015), it is therefore necessary to first agree upon what value is.

Table 1.3 Previous work value and their main contribution

| **Authors** | **Subject explored** | **Main contribution** |
|---|---|---|
| Skaar (2022) | Value definition | Framework with guiding principles for flow and value creation |
| Drevland, Lohne, & Klakegg (2018) | Value definition | Comprehensive definition of value, emphasizing its subjective nature and importance in Lean Construction |
| Haddadi, Temeljotov-Salaj, Foss, & Klakegg (2016) | Value definition | Literature review across multiple contexts, establishing a common understanding of value for owners and users. |
| Giménez, Herrera, & Sánchez (2023) | Value attributes | Identification of 28 value attributes related to the design phase |
| Khalife, Emadi, Wilner, & Hamzeh (2022) | Value attributes | List of value attributes to be used as the starting point for project teams value definition processes |
| Chbaly & Brunet (2022) | Value alignment between stakeholders | Framework for Lean-led design use to value alignment |

Table 1.4 Previous work value and their main contribution (continues)

| **Authors** | **Subject explored** | **Main contribution** |
|---|---|---|
| Khalife & Hamzeh (2019) | Value fulfilment | Framework that considers factors affecting value generation and improvement |
| Khalife, Shehab, & Hamzeh (2024) | Value fulfilment | Simulation model to evaluate team interactions and their impact on value fulfillment |
| Khalife & Hamzeh (2023) | Value fulfilment | Value identification game for stakeholders to navigate and resolve dilemmas in value delivery |
| Tillmann, Tzortzopoulos, & Formoso (2013) | Value fulfilment | Review two existing value management practices and present their contribution to value delivery |
| Thyssen, Emmitt, Bonke, & Kirk-Christoffersen (2010) | Value fulfilment | Workshop model that allows client values to incorporated early in the design process |

Emmitt et al. (2005) presents value as being part of economists' definition of productivity, in which productivity is value divided by resources. Kelly (2007) presents that the most common expression for value is the ratio of function over cost.

Whereas Salvatierra-Garrido & Pasquire (2011) breaks the concept of value to the construction industry into two groups (Figure 1.4) , First Value and Last Value. The latter model presented seeks to encompass three project level domains (production and delivery capability, stakeholder perspective and social perspectives) and four society level domains that impact sustainability (technology, economics, environment, and politics) of value.

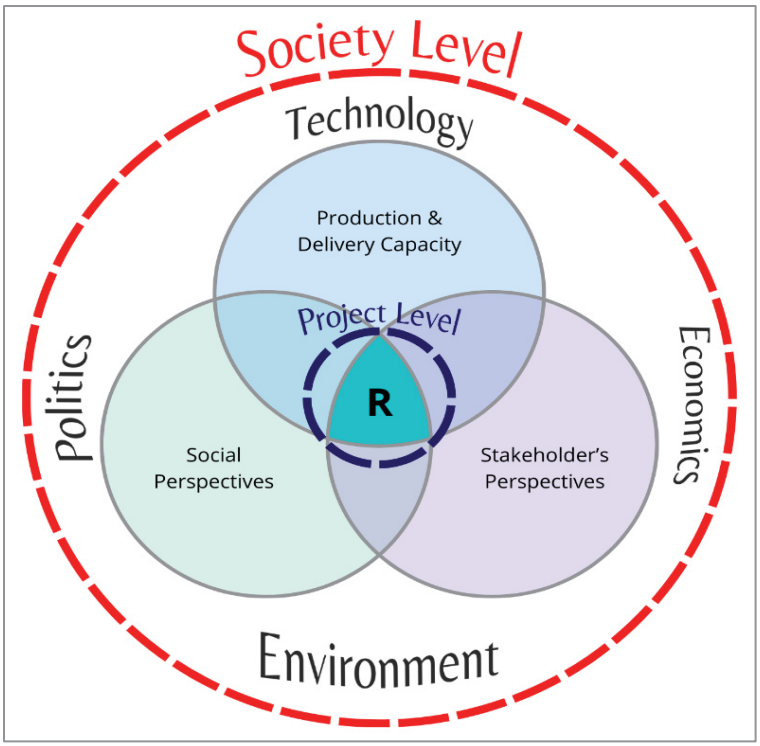


Figure 1.4 Value generation domains and perspectives
Adapted from Salvatierra-Garrido & Pasquire (2011, p. 6)

As presented above, the factors involved in generating the requirements (R in the Figure 1.4) for a project, that later will be translated into value are dependent not only on the customer's objectives but also on several factors affected by the constructed building. Within the factors considered is the user's perception. Womack & Jones (1997) point out that value can only be defined by the end user/end customer. Finally, as different types of environments are used by different users, especially when it comes to environments such as hospitals and schools, rethinking how these buildings are designed and built becomes a necessity.

## 1.5 Requirements management

As previously mentioned, the generation of value has a large number of variables and for the project team to be able to generate value and create a project adapted to the needs for the multiple stakeholders, it is necessary that these values are translated into clear requirements to

facilitate the integration between the different disciplines and the measures that must be taken in advance that can affect the entire construction life cycle (Kamara, Anumba, & Evbuomwan, 2000).

In complex and large-scale projects, composed of many stakeholders, there are a large number of requirements to be considered, Serugga et al. (2020) lists nine essential categories of requirements (economics, sociocultural, health and safety, technical, life cycle performance, occupancy, geopolitics, environment and governance).

The construction industry currently uses a linear process in which the definition of requirements is a specific step in the entire project definition process. This process, however, does not reflect reality as the evolution of the project, design and construction is accompanied by the evolution of the client's needs.

As well as being clearly defined, project requirements must be managed throughout the duration of the project. Kiviniemi (2005) proposes an iterative requirements management model which is constantly updated as the project and the client's perspective evolves (Figure 1.5), in order to provide a result better adapted to the client's needs.

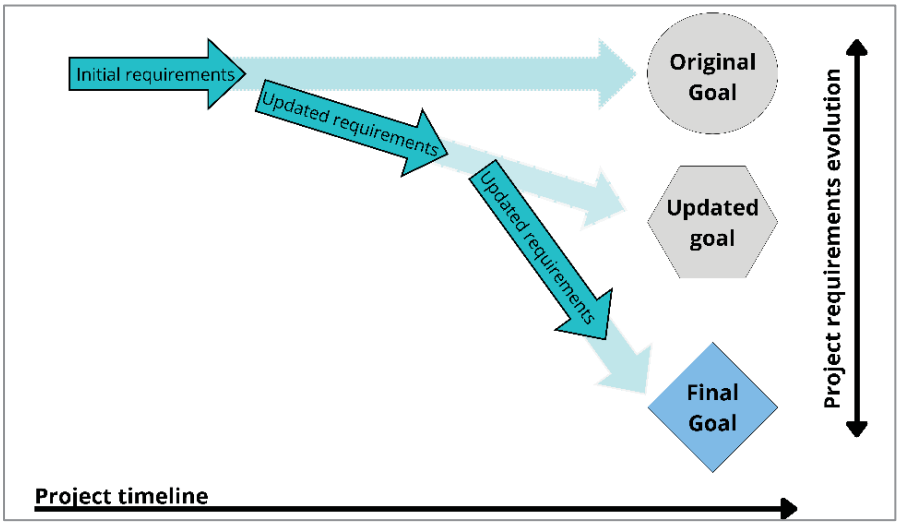


Figure 1.5 Project requirements evolution
Adapted from Kiviniemi (2005, p. 6)

## 1.6 Target Value Delivery

The TVD approach is an evolution of methodologies that emerged after the industrial revolution, such as target costing and value engineering (Karaz & Teixeira, 2023; Ballard, 2020), these methodologies differ from existing methodologies until then by seeking to reduce the costs of the final product. Although such methodologies are well adapted to the manufacturing sector, where competition between companies stimulates the elaboration of innovation and short test cycles, the construction reality is different.

When adapted for the construction industry, target costing received the incorporation of the concept of value, with the objective of increasing/ensuring the added value of the project for all stakeholders, including the end user (Macomber, 2007), the then called Target Value Design and later Target Value Delivery.

The primary goal of TVD is to generate value, reduce waste, and foster innovation, which, when approached systematically, should naturally result in cost reduction (Ballard, 2020; Karaz & Teixeira, 2023; Malvik et al., 2021 b). However, the practical application of TVD has diverged from its theoretical underpinnings.

The process for applying TVD should follow a series of steps, beginning with the development of a business case for the project, followed by its validation and the definition of project targets. This is followed by steering the design towards these targets and, ultimately, steering the construction phase towards meeting the established targets. In this context, the targets should encompass not only cost objectives but also factors such as safety, social impact, environmental sustainability, and other relevant considerations.(Ballard, 2020)

In practice, many projects adopting TVD tend to focus more on direct cost and risk reduction rather than on generating value (Rybkowski et al., 2022). This shift in focus, driven by the desire for immediate cost reductions and increased profits, limits the potential for projects to deliver broader value to society. The emphasis on minimizing risks can stifle innovation

(Malvik et al., 2021 b). While these constraints have always been present in construction, the increasing complexity of modern projects, fueled by advancements in technology and productivity, makes these issues more pronounced and detrimental.

The problems mentioned above become even more critical to the application of the methodology when combined with the ambiguities that arise with the notion of value.
Indeed, the concept of value, as already explained in this document is complex, changeable and linked to the individual perceptions of each person (Drevland & Lohne, 2015).

Moreover, TVD is specifically categorized as a production process rather than a contractual framework. As such, it does not establish a formal contractual concept. However, as stated by Ballard (2020) the application of relational contractual methods is considered of great interest for the successful execution of TVD, especially in high-complexity projects. This need for effective contract structures has led to the emergence of Integrated Project Delivery (see section 1.9), which provides a contractual framework designed to support projects focused on value creation.

Despite the introduction of new contractual methods and approaches for the successful implementation of value-driven projects, many initiatives adopting a value-focused methodology still struggle to clearly define the project's values. This failure can arise from a narrow focus on technical aspects, inadequate management of requirements, or an overemphasis on the client's perspective while neglecting the needs of the end users. As a result, the final building may be poorly adapted to its intended uses (Drevland & Tillmann, 2018; Miron et al., 2015).

## 1.7 Lean Led Design

The Lean Led Design (LLD) or 3P (Production, Preparation and Processes is an approach that integrates Lean principles into the design phase of complex projects. Its popularity is growing, especially in large-scale projects, which many stakeholders, in sectors such as healthcare.

Some examples include the Zaans Medical Centre (Schouten, Heusinkveld, Van Der Kam, & Benders, 2020), the endoscopy department at the Queen Elizabeth Hospital (Hicks, McGovern, Prior, & Smith, 2015) and the *nouveau complexe hospitalier* du Québec (Chbaly, 2021).

At its core, LLD aims to enhance quality, safety, and effectiveness while reducing waste in the design process(Grunden & Hagood, 2012). This is achieved by aligning design work closely with the needs and routine of the end users. As a user-centered approach, LLD prioritizes optimizing the flow and ensuring that the design meets the long-term needs of those who will interact with the facility. The emphasis on user flow makes LLD a methodology that focuses not only on operational efficiency but also on delivering a design that enhances user experience and usability.

A key feature of LLD is its focus on the interaction between users and professionals, with both parties actively participating in defining the project's values and needs. This collaboration is vital to the success of the methodology. However, as pointed out by Caixeta & Fabricio (2021) a significant challenge lies in fostering effective collaboration between users and professionals. LLD gives more decision-making power to users, a shift that can conflict with traditional hierarchies within the construction industry. This change requires more fluid communication and the sharing of information between professionals from different disciplines, which is often obstructed by the silo mentality that still exists within construction environments.

Additionally, during the implementation of LLD, both users and professionals face difficulties in defining future needs. According to (Schouten et al., 2020), users who are involved in defining the value stream may not be the same individuals who will use the completed project. As a result, they must make educated predictions about what will be required in the future, which can be challenging since the project may not be completed and operational for several years. To address this, it is essential for users and professionals to collaborate in a way that ensures the design can be adapted to meet future needs. Defining elements that can evolve and remain flexible is crucial for accommodating changes and new requirements that may arise once the project is completed and in use.

Lean Led Design encourages a design process that is continuously shaped by user feedback. By leveraging Lean tools, LLD fosters collaboration and incorporates user input into the design, ensuring that the final solution is more closely aligned with the users' needs. Among the Lean tools employed in the LLD approach is the Kaizen workshop. These workshops enable participants to focus closely on specific problems, using the team's collective capabilities to develop the most efficient solutions (Grunden & Hagood, 2012). Consequently, Kaizen workshops offer significant benefits, serving not only as a core component of LLD but also as a standalone strategy to drive substantial improvements while minimizing resource usage.

## 1.8 Integrated Design Process

The integrated design process uses a multidisciplinary and collaborative approach which starts at the beginning of the project life cycle, focusing in developing integrated, sustainable and optimized solutions.

In Quebec specifically, the stages followed by the project teams involved in this process range from the programming stage to the operation stage, with implication from different teams varying between the different moments (Figure 1.6).

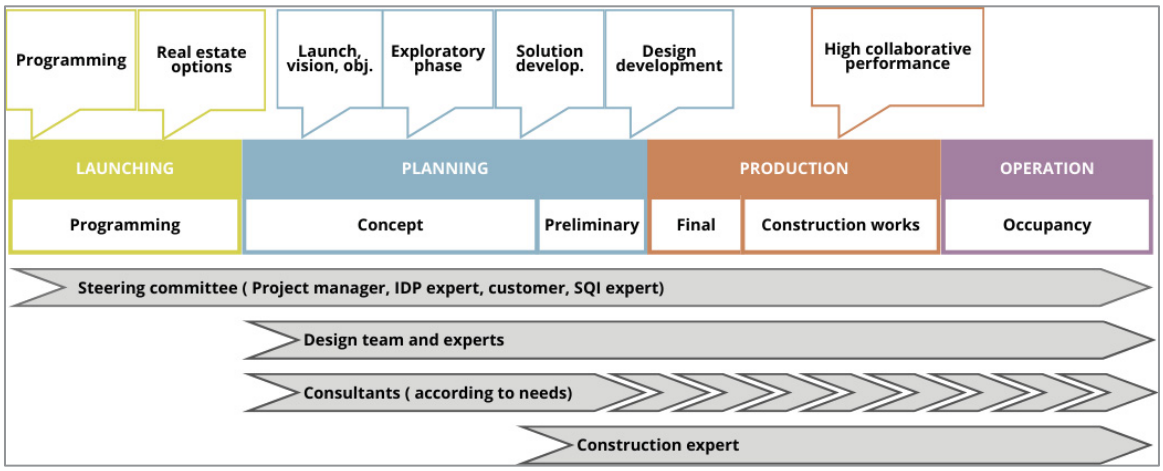


Figure 1.6 The Integrated design process followed in Québec
Translated from Société québécoise des infrastructures (2016, p. 8)

As illustrated in Figure 1.6, the IDP implemented in Québec includes the involvement of a steering committee throughout the entire project lifecycle. This committee comprises the project manager, an IDP facilitator, a client representative, a representative from the professional team, and the head of the agreement with the government. The primary role of this committee is to coordinate and plan the IDP workshops, ensuring structured collaboration and alignment among all stakeholders involved.

The consultants presented in Figure 1.6 brought into the project, following the guidelines presented by Société québécoise des infrastructures (2016), can include representatives from public agencies, construction specialists, end-users, commissioning agents, acousticians, regulatory experts, and others. It is mentioned that these consultants should be involved at the optimal stage of the project, aligning their participation with the specific needs and requirements of each phase.

Each stakeholder has a clearly defined role and function as outlined in the guide provided by the Société Québécoise des infrastructures (SQI) for the implementation of the IDP process. It is the responsibility of both the stakeholders and the process facilitators to continuously reaffirm and fulfill their roles, ensuring the smooth progression of the process and the success of the project.

### 1.8.1 Principles of IDP

IDP is characterized by several key principles that distinguish it from traditional design approaches, these principles are presented by Forgues & Dionne (2015) and summarized below:

- **Collaboration and Multidisciplinarity:** It facilitates the integration of expertise from various disciplines, creating an environment for collective problem-solving. It emphasizes the co-creation of solutions where knowledge is shared openly among the team.

- **Integrated and Sustainable Solutions:** By adopting a holistic view of the building, IDP focuses on optimizing interactions between elements and systems, aiming for durable outcomes. The emphasis on sustainability is evident through energy efficiency, water conservation, and the use of renewable resources.
- **Lifecycle Perspective:** Unlike traditional linear approaches, IDP covers the building's full lifecycle, from initial design through construction, operation, and eventual demolition.
- **Iterative Workshops (Charrettes):** Creativity and consensus-building are fostered through structured, intensive multidisciplinary workshops. These sessions aim to address complex issues, ensuring all stakeholders are involved in the decision-making process.

The Integrated Design Process is a collaborative approach that emphasizes solution development during the design phase, with a focus on sustainability, functionality, and cost-efficiency. While the process does not prescribe a specific contractual structure, it does define distinct roles, each with its own responsibilities in the decision-making process.
In contrast, Integrated Project Delivery (IPD) is another collaborative methodology that differs from IDP in terms of its focus, implementation stages, and contractual arrangements. The IPD methodology is briefly presented in the following paragraphs.

## 1.9 Integrated Project Delivery

Integrated project delivery has emerged in early 2000s (Ashcraft, 2022) as a methodology that establishes a framework for the relationships and decision-making process in construction projects. The main concepts addressed in the methodology are collaboration between stakeholders, a more intensive planning phase, the use of appropriate technologies and good organization and leadership throughout the project lifecycle.

Each of these basic concepts has clearly defined rules that if followed ensure the success of the project. Collaboration between stakeholders is one of the most central tenets of IPD. It depends on open communication, mutual respect, and shared risks and rewards.

Collaboration should start from the very beginning of the project, and for this to occur more smoothly, all key project participants should be involved early in the project. This early involvement ensures that each participant's input is considered and that everyone is aligned with the project's goals from the beginning.

However, a significant issue arises concerning the definition of "key participants" in collaborative construction projects. While the theory behind IPD highlights the importance of the end user input to ensure the success of the process (AIA, 2007; Allison, Ashcraft, Cheng, Klawans, & Pease, 2019) and some authors being clear on the importance of the end-user presence in the collaborative project definition process(Chbaly, 2021), most of the existent literature (Rybkowski et al., 2022; Malvik et al., 2021 b; Morêda Neto, Bastos Costa, & Coelho Ravazzano, 2019) identifies the key participants as the project professionals and clients, with small or no mention of the end user. This contradiction can lead to the improper application of IPD processes if project managers fail to acknowledge the critical role of the end user input in the project early phases.

When it comes to project planning according to AIA (2007) and Ballard & Zabelle (2000), the objectives of the project must first be established, this step must be attended by all stakeholders to establish the values and conditions of satisfaction of the project, these two components will be used as a guide for subsequent steps, so it must be considered and accepted by all involved.

The IPD theory focuses heavily on the interactions between project participants, according to this theory project members should be in synchrony, both in the project definition stage and in the design and construction stages. Bhonde, Zadeh, Staub-French, & Goodland (2020) however highlights the fact that working in silos, still widespread in the AEC industry, is a

hindrance to the proper execution of IPD, requiring a shift in the culture within the companies themselves to adapt to this new project structure strategy.

## 1.10 Literature Overview

The construction industry continues to grapple with persistent challenges such as inefficiency, fragmentation, and lack of transparency. These issues have prompted a shift toward methodologies like Target Costing, Value Engineering, and more recently, Target Value Delivery. These approaches emphasize cost control and value creation, aiming to improve project outcomes by aligning them with stakeholder needs. However, while TVD offers a promising framework for addressing cost overruns and fostering collaboration, its practical adoption remains poorly documented, particularly in terms of effectively incorporating end-user input during the early stages of construction projects.

A critical gap identified in the literature is the limited understanding of how to systematically integrate users into the project definition phase—a stage widely recognized as pivotal to a project's success. Although participatory design approaches are acknowledged for their potential to enhance decision-making and ensure that projects meet both client and user expectations, there is a lack of detailed guidance on how to operationalize user inclusion in practice. Existing studies primarily focus on client-driven processes or lean methodologies that emphasize efficiency yet fall short in exploring how to engage end users meaningfully and consistently throughout the project life cycle.

The challenge of integrating users into the construction process is compounded by the industry’s traditional focus on cost, schedule, and risk management, often at the expense of a deeper understanding of user values. In complex projects, this results in environments that may meet functional requirements but fail to address the nuanced needs of the users who will ultimately inhabit and interact with these spaces. As the literature suggests, this disconnect is largely due to the fact that user involvement is often relegated to later stages, if it occurs at all, rather than being an integral part of the value-setting process from the outset.

While tools such as Lean-led design (LLD), IDP and IPD offer mechanisms for improving collaboration, they do not fully address the intricacies of user engagement. Lean methodologies, with their focus on waste reduction and process efficiency, are valuable for managing project complexity but offer limited direction on how to involve end users effectively. Similarly, while IDP and IPD promotes stakeholder collaboration, much of the projects focus remains on professional teams and clients, leaving end-user participation as an underexplored area.

Thus, the gap this thesis addresses is the lack of clear strategies for incorporating end users into the project definition phase. While the literature recognizes the value of user involvement, it does not provide sufficient insight into how this can be systematically achieved in practice. Understanding how to integrate user perspectives early in the construction process is crucial for delivering projects that not only meet technical and budgetary requirements but also align with the real-world needs and values of those who will use the space.

# CHAPTER 2

# RESEARCH METHODOLOGY

The research methodology employed is that of constructive research. In this methodology, the researcher seeks to address a problem of relevance and propose a solution to that problem. Addressing from the start of the project the identified problem of the lack of relevance of academic researchers mentioned by Lukka (2003).

The problem to be addressed is the generation of value in construction projects, more specifically how best to determine value in a participatory design context. In fact, value creation is a field that is not often addressed and its link with the development of collaborative projects is even less explored, and such approaches have only recently begun to gain prominence on the construction world stage.

The main assumption considered to address the problem is that the use of the tools provided by participatory and Lean approaches assists value-driven decision making and user inclusion in construction projects and that their structured application can improve the value delivered by those projects, this assumption guided the case studies choice and analysis.

The researcher will be following two projects being carried out in IDP they will be part of the project as an observer and working on the collection of information for further processing following the case study strategy.

As mentioned above, data collection will be carried out as in a conventional case study manner, using observations, interviews and document analysis as the basis for analysis and the proposal of a possible solution. The analysis of the data collected in both case studies allows the proposition of a new method of approaching participatory design projects to make them more value oriented.

The theoretical contribution of this study is to enrich the existing knowledge on value generation in the design of built environments, as well as to provide an alternative method of exploring the concepts in greater depth, based on real cases. This way, researchers can identify the possible do's and don'ts when it comes to participatory design, as well as the critical points to be considered when carrying out and studying participatory design.

## 2.1 Research methodology framework

The framework used in this research, outlined below, is based on the structure defined by Lehtiranta, Junnonen, Kärnä, and Pekuri (2016) and has been specifically adapted to explore the multiple unique case studies explored in this research.

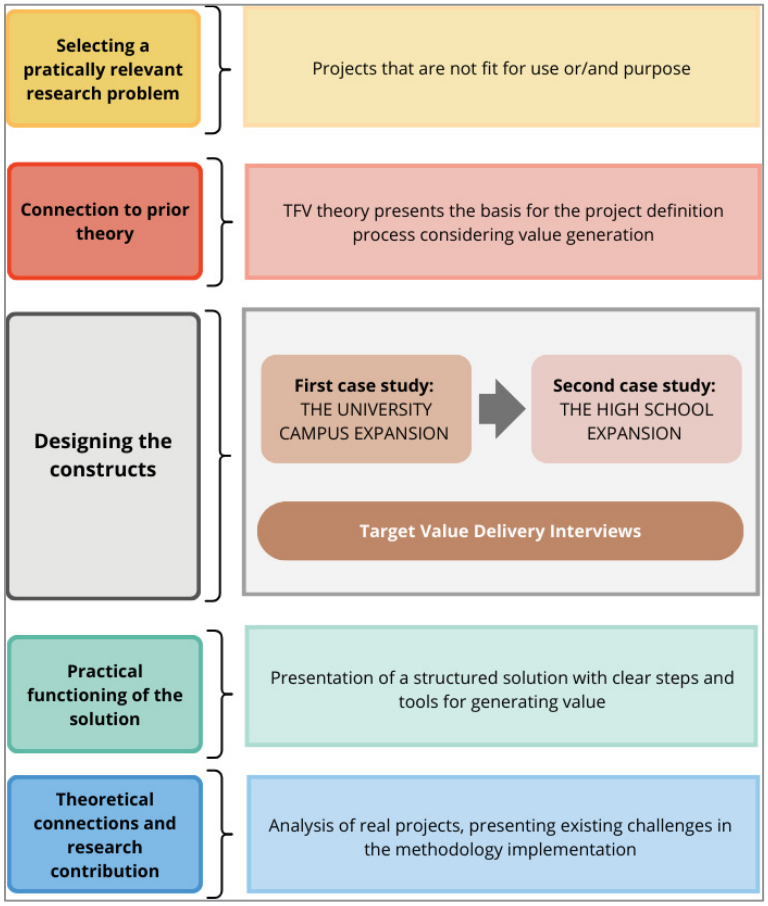


Figure 2.1 The constructive research process for this thesis

### 2.1.1 Practical relevance of the problem and solution

As stated by Oyegoke (2011) the choice of the research problem can be based on practical experience or on theoretical work. From a practical standpoint the construction industry demonstrates a need for better methods capable of delivering real added value in its projects within time and budget constraints. Theoretical work and case studies carried out in recent years (Remila, 2023; Tillmann, 2012) bring the finding that despite recent efforts there is still a lack of alignment between solution delivered and stakeholders requirements. This culminates in developments that are poorly adapted to their future or even current uses, resulting in wasted space and time for the end users of the project.

From the literature reviewed in early stages of this research project the input considered in most participative construction process is provided mainly from the project owner and the professionals in the project, there is a lack of the final user input in these projects.

### 2.1.2 Connection to prior theory

The transformation, flow and value theory by Koskela (2000) creates the basis for the exploration of the project definition process in the value generation context (Figure 2.2).

Following this theory the project definition must consider three views. The transformation view, the flow view and the value generation view.

The transformation view that as the name instate delas with the transformation of inputs into outputs, so for the stage considered, the transformation of client requirements into a design solution. The flow view brings the lean notion of waste elimination, searching to make the process the more optimized, with a constant flow of information.

Finally, the value generation view that searches the elimination of value loss requiring a good capturing of client needs before the design execution.

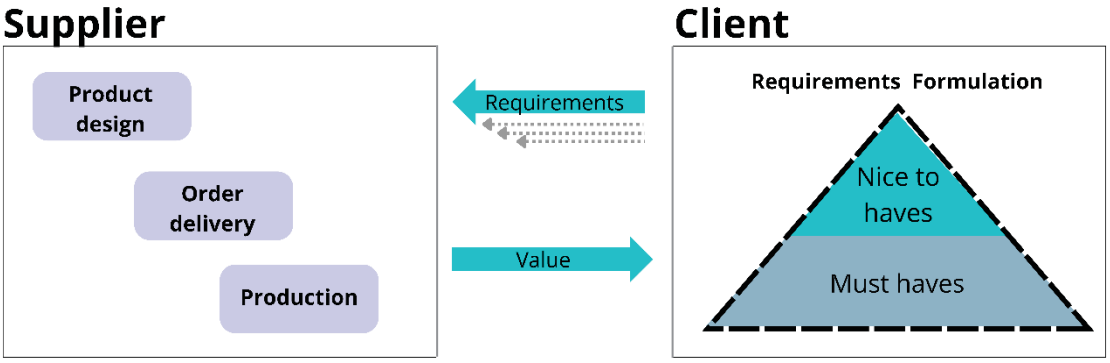


Figure 2.2 Principles related to the value generation concept
Adapted from Koskela (2000, p. 79)

### 2.1.3 Constructs design and practical functioning of the solution

Among the benefits of constructive research, we have the use of various resources for constructing and analyzing a solution. Therefore, this project will involve the analysis of real cases, documentary reading, and interviews with professionals in the field.

**Case study:**

The choice to focus on case studies arises from the nature of the question being addressed. As indicated by Yin (2003), although case studies represent only one of several alternatives for conducting social science research, they are the best option when addressing questions such as how and when the researcher has little control over events in a contemporary context.

**Cases choice:**

The research question pertains to the execution of highly complex construction projects. To explore this topic in the appropriate context, the selected cases align with this high-complexity context—specifically, school projects. These projects involve many stakeholders, each with different personalities and objectives, especially when it comes to end users of such projects.

Since the explored process requires collaboration among project stakeholders, the selected cases (see Figure 2.3) also demonstrated development within a participatory context.
Finally, the exploration of the initial case studies helps verify the problem with user participation, while the second case provides greater clarity about the proposed solution.

**TVD Interviews:**

Simultaneously with the case studies, the implementation of TVD was explored. To gain a broader understanding of TVD in practice, interviews, presented in chapter 5.2, were conducted with various professionals who had applied this approach in different project contexts. These interviews aimed to observe how the TVD process specifically incorporates user input, with the objective of identifying gaps in the methodology and exploring potential tools that could positively impact user inclusion during the project definition phase.
All the interviews have been conducted with experts in the field of lean construction who have worked on projects using the TVD.

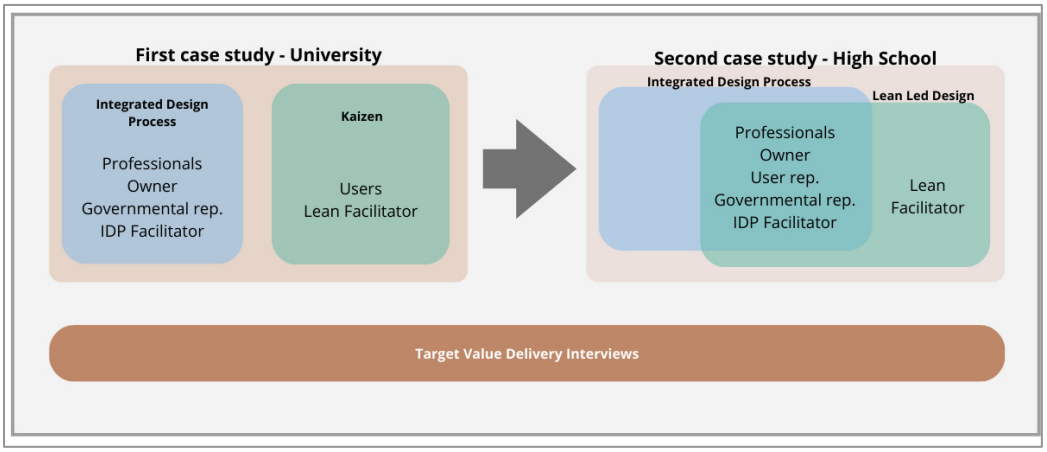


Figure 2.3 Constructs design process

Although a complete test of the construct won't be conducted due to schedule limitations imposed by high-complexity projects, the practical solution proposed may be applied in a future TVD project.

### 2.1.4 Theoretical contribution of the study

The theoretical contribution of this study arises from the analysis of the case studies, specifically through the lens of end-user participation during the project definition phase.

Given that this topic is still sparsely explored in the industry, the study aims to enhance existing knowledge by providing new insights and tools for incorporating users in the early stages of complex construction projects. The focus is on enabling the delivery of a project that is better adapted to its intended use, thereby increasing its overall value.

## 2.2 Research reliability and validity

To ensure the validity of this research, multiple strategies were employed to enhance the study's trustworthiness and credibility, aligning with established practices in qualitative research. These strategies include triangulation, member checking, thick description, purposive sampling, audit trail, and reflexivity, each of which is detailed below.

Triangulation was employed by using multiple sources and methods of data collection to cross-check findings, which is essential for validating qualitative research (Gagnon, 2010; Yin, 2003). This approach included interviews, document analysis and observations, allowing for a comprehensive perspective on the research question and facilitating a robust comparison of insights. Triangulation contributed to the credibility of the study by minimizing the impact of individual biases and ensuring that findings were supported by diverse data sources.

Member Checking involved sharing preliminary findings with key informants of the case studies. As supported by Gagnon (2010) and Yin (2014) this approach allows participants to verify the accuracy of interpretations, indirectly supporting the validity of the findings, thereby enhancing the credibility of the study.

A Thick Description of the context, participants, and research setting was provided to support Transferability. By offering detailed contextual information, this study enables readers to

assess its relevance to their own contexts. While transferability cannot be guaranteed, a rich description of the research environment and context provides sufficient information for others to determine the study's applicability (Yin, 2014).

Purposive Sampling was employed to select participants who could provide deep insights into the phenomenon under investigation. Patton (2010) and Yin (2014) highlight purposive sampling as an effective method for identifying information-rich cases, while Gagnon (2010) emphasizes its utility in ensuring relevant perspectives are represented. This sampling method ensured that the participants included in the study had the experience necessary to inform the research question comprehensively.

An Audit Trail was maintained throughout the research process to support Dependability. Yin (2014) advocates for a chain of evidence in case study research. Detailed records were kept of each phase of data collection and analysis, allowing for transparency in the study's procedures. This audit trail provides a clear outline of the research process, enabling others to follow the steps taken and ensuring the dependability of the findings.

Reflexivity was integrated into the research design by incorporating ongoing self-reflection. As described by Finlay (2002), reflexivity enables researchers to critically examine how their own biases and perspectives might influence the research process. In this study, reflexivity was practiced by maintaining a journal throughout the research, where reflections on personal assumptions and their potential impact on data collection and interpretation were documented. Both Gagnon (2010) and Yin (2014) highlight the importance of researcher self-awareness and impartiality in qualitative research. This practice of reflexivity supports confirmability, ensuring that findings are based on the data itself, rather than being influenced by the researcher's personal biases.

By implementing these strategies, this study strives to achieve a high degree of validity, ensuring that the findings are credible, dependable, transferable, and confirmable within the context of qualitative research.

# CHAPTER 3

# CASE 1: THE UNIVERSITY CAMPUS EXPANSION PROJECT

## 3.1 Context

This project is an expansion project for the ETS university campus, situated on the site occupied by an old brewery—a historically significant location for the region. The project development started in the summer of 2021, with initial workshops aimed at defining objectives. Its planned completion date is the winter 2028 The project will be developed in three phases, the first phase being the focus of this research observations.

The project followed a participatory design process, and during the analysis stages, the contractual execution method had not yet been determined. Key project stakeholders (client and government representatives, architects and engineers, external facilitators and professors from the main department affected by phase 1 of the project) were involved in this design process, based on the type of workshop. Figure 3.1 illustrates the sequence of workshops conducted throughout the project and
Table 3.1 presents the workshops dates and subjects.

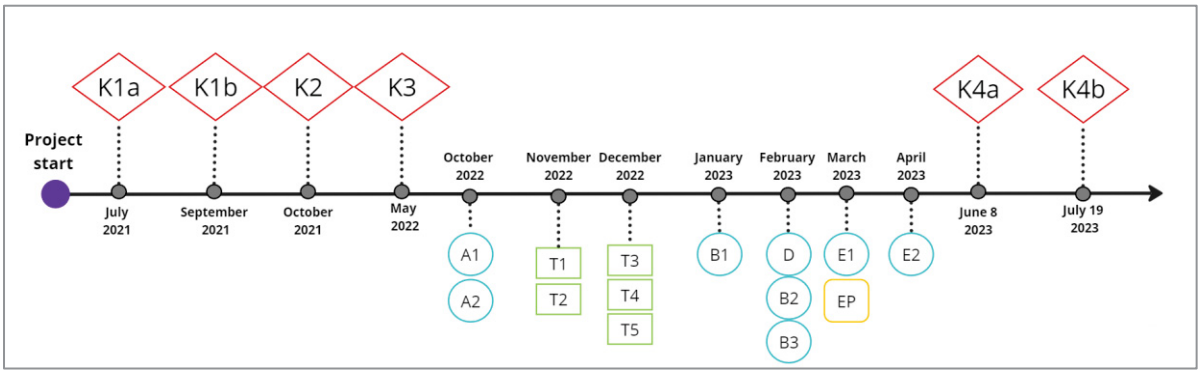


Figure 3.1 The university campus expansion project definition phase timeline

Table 3.1 The University Campus workshops dates and subjects

| Worksops | Date | Subject |
|---|---|---|
| K1a | 13/07/2021 | Strategic issues |
| K1b | 02/09/2021 | Guiding principles |
| K2 | 02/11/2021 | Added value and synergy |
| K3 | 12/05/2022 | Rehabilitation of Pavillon A |
| A1 | 06/10/2022 | Site visit, project vision, objectives, challenges and risks |
| A2 | 20/10/2022 | Project vision and objectives improvement |
| T1 | 24/11/2022 | Heritage, Archaeology and history of the site and condition of existing buildings |
| T2 | 24/11/2022 | Program Challenges |
| T3 | 01/12/2022 | Urban Integration |
| T4 | 01/12/2022 | Sustainable Development |
| T5 | 15/12/2022 | Synthesis workshop |
| B1 | 19/01/2023 | Analysis of real estate options |
| D | 02/02/2023 | Real estate options and phasing issues |
| B2 | 16/02/2023 | Promising real estate options |
| B3 | 23/02/2023 | Evaluation grid and Promising real estate options |
| E1 | 15/03/2023 | Evaluation grid and final real estate options |
| EP | 23/03/2023 | Completion of the evaluation grid internally by ETS |
| E2 | 27/03/2023 | Completion of the evaluation grid from all IDP participants |
| K4a | 04/04/2023 | Mutualisation exploration |
| K4b | 08/06/2023 | Space allocation exploration |

## 3.2 Project activities

The activities carried out in the mentioned workshops are described below:

**Workshop K1**

The workshops K1a and K1b involved the participation of professors from the LOG-TI department, the users of the future space developed in the first phase of the DOW project. This workshop was conducted within the context of participatory design, using the Lean method known as Kaizen.

During this workshop, future users of the space were assisted by an external facilitator in defining the vision for the new location. Workshops K1a and K1b focused on projecting the professors into the future of the project, ensuring that the definition of the new building's vision aligned with the project's completion date. The strategic plan and functional program of the project were validated based on these insights.

At the end of the two afore mentioned workshops, the following values and satisfaction conditions were defined:

1. TEACHING AND RESEARCH - An inspiring environment, a catalyst for collaboration and creativity
    - Consideration of multiple learning paths requiring varied environments
    - Integration of research with teaching and student life (places of exchange)
    - Combining open and secure collaborative spaces
    - Creation of functional clusters for research and collaboration
    - Collaborative, flexible and modular spaces (enabling fast configuration changes)
    - Interdisciplinary spaces within and between departments

2. CLOSE TO THE INDUSTRY AND THE COMMUNITY - The place where engineering talent meets and collaborates with industry and community partners.

- Partner and community access to collaborative spaces and technologies
- Collaborative spaces open to other external specialists and researchers (medicine, social sciences, arts)
- Consideration of dedicated paths for equipment entry and exit
- Creation of showcases for visibility and the sharing of success stories with a focus on research promotion
- Creation of an innovation hub including rooms for ideation and teamwork with flexible furniture

3. TECHNOLOGY - An identity rooted in technological innovation at the service of society and people
   - Infrastructure supporting virtual environments and learning in hybrid and co-modal modes
   - Creation of spaces for evaluating and showcasing new prototyping technologies
   - Creation of spaces for commercial monitoring of technologies available on the market
   - Development of teaching rooms integrating virtual and augmented reality tools

4. ENVIRONMENT AND SUPPORTING SERVICES - An efficient environment facilitating the user experience and our mission
   - An environment that facilitates technology and equipment sharing
   - Smoother user experience for students, professors and researchers
   - Enhancing the organization's social vocation
   - Highlighting ÉTS's industrial heritage in contrast to technological innovation

5. COMMUNITY LIVING AND INTEGRATION ENVIRONMENT - A pleasant, stimulating, inclusive living environment open to the community
   - Openness to the community facilitating accessibility, sharing and visibility (e.g.: transparent laboratories)
   - Creation of social spaces to gathering (eating, socializing, playing, etc.)

- Creation of social and sports spaces
- Favoring spaces with natural light
- Consideration of spaces that meet specific customer needs (equity, inclusion, diversity)

6. ECORESPONSIBLE CAMPUS - A green campus that inspires sustainable development
   - Ecoresponsible resource management
   - Consideration of carbon neutrality and energy efficiency in construction and operations
   - Integration of green spaces to create a natural living environment
   - Facilities for efficient and responsible waste management
   - Highlighting sustainable development projects

**Workshop K2**

In the K2 Workshop, also conducted in the Kaizen format, professors gathered to identify functional program requirements that truly add value to the project, as well as potential synergies to optimize the spaces. During this workshop, participants reflected on unifying the different visions obtained in the K1 workshop, providing a clear vision and master plan for the innovations to be implemented in the DOW project.

**Workshop K3**

The K3 Workshop involved professors from the construction department—the department that will occupy the vacant areas when the LOG-TI department moves to a new building. The focus of this workshop was the adaptation of the existing building.

**Workshops IDP**

The IDP Workshops were conducted in the Big Room, with the participation of project professionals, the client, government representatives, and the facilitator.

**Workshop A1:**

The primary objective of the first IDP workshop was to present the results from the participatory design workshops, ensuring alignment of professionals with the vision and objectives set by the professors. Based on this information, project participants defined project needs, risks, and their inspirations.

**Workshop A2:**

In this IDP workshop, the objectives and risks defined in Workshop A1 were further refined by participants, considering new insights brought to the project. The discussions in this workshop allowed for a more comprehensive vision, incorporating the perspectives of other project participants. Additionally, participants analyzed the site to identify critical considerations for the design process.

The technical workshops conducted subsequently are not a frequent practice in IDP projects carried out in Quebec, but they were added to this project due to the stakeholders' realization of the complexity of the site.

**Workshop T1:**

This workshop focused on discussing the heritage and historical aspects of the site, as well as the situation of the existing buildings. Points related to the decision-making process regarding conservation or demolition were considered. Architects, structural engineers, mechanical engineers, the client, and government representatives participated in this workshop.

**Workshop T2**

This technical workshop continued with the same focus as the previous T1 workshop, exploring programmatic risks related to the requalification of the DOW complex. Professionals involved in this workshop presented their analyses and recommendations for each of the existing buildings on the site. Based on the information presented, the professionals were divided into subgroups to identify essential elements for the continuation of design work and solution proposals.

Figure 3.2 Group Discussion during workshop T2

**Workshop T3:**

This technical workshop aimed at integrating the new spaces with the surrounding region. It considered both architectural links with the environment and mobility aspects during and after construction. Regulations relevant to the design of the spaces were also presented. Similar to the previous technical workshops, this workshop began with an initial presentation to level the knowledge of all participants. Subsequently, smaller group discussions identified points to be considered in designing solutions.

**Workshop T4:**

The central theme of this workshop was sustainable development. It started with an initial presentation on concepts such as carbon neutrality, energy efficiency, and certifications—particularly related to sustainable development plans developed by ETS. After the presentations, participants engaged in discussions to identify focus areas based on the established requirements for the site.

**Workshop T5:**

The fifth and final thematic workshop was organized to provide a summary of the discussions and decisions made in the previous workshops, ensuring that all participants were informed.

**Workshop B1:**

This workshop focused on presenting real estate solutions. Building upon the discussions from the previous workshops, architecture professionals developed options considering project needs. Their approach involved creating options with varying levels of conservation for the existing buildings. Benefits were presented based on programmatic, urban, and sustainable development criteria established by the architects themselves. These criteria served as reference points for comparing the options. The architects developed 11 options across 7 different levels of conservation, ranging from preserving the structure of 2 of the existing buildings to complete demolition. The workshop primarily involved professionals presenting the options, followed by analysis and feedback from other participants, who provided comments, suggestions for improvement, and ideas for combining options.

**Workshop D:**

This workshop followed Atelier B1 and was organized with the aim of identifying potential issues related to the order of phases defined in the project. The goal was to determine the ideal location for starting construction on the first building of the new complex.

During this workshop, an initial presentation informed participants about the modifications made by the designers based on the suggestions from the previous workshop. Using these new solutions, the entire group conducted analyses and provided additional comments on the proposed solutions. Subsequently, participants were divided into two groups to closely evaluate the options concerning the order of phases. They identified critical tasks based on project requirements and operational continuity. The points raised during these group discussions were shared with all participants to ensure everyone had the same level of information.

**Workshop B2:**

This workshop also focused on real estate options analysis. However, the analysis considered the presentation of accessibility possibilities by the mobility analysis lead and the insights provided by the structural professional regarding the utilization of existing structures. Discussions occurred in small groups, allowing each group to write comments directly on the plans for each option.

Figure 3.3 Group Discussion during workshop B2

**Workshop B3:**

This workshop was divided into two phases. First, a government representative presented how each team should use their option analysis tool. The second stage involved more in-depth discussions about critical points related to the options. These options were modified based on the suggestions from participants in Atelier B2. After these presentations, teams were further divided into groups to carefully assess each option, focusing on areas for improvement and potential combinations. Ultimately, a decision was made regarding the best options to retain, considering input from each subgroup.

Figure 3.4 Notes made by a group during workshop B3 discussions

**Workshop E1:**

In this shorter workshop, the latest version of the evaluation tool was presented, including all the criteria to be assessed, as well as a presentation of the most recent available versions of the developed options. With this information in mind, participants had a dedicated period to raise their questions. This workshop was organized with the aim of empowering each stakeholder to evaluate the options, ultimately selecting the best choice at the end of the process.

**Workshop EP:**

This workshop involved stakeholders filling out the grid according to the established IDP procedure. Each stakeholder discussed the notation for each criterion related to the developed options with their team. The specific context for this workshop was the notation of options by the Client. During this workshop, the Client brought together various participants who had been part of the Big Room discussions and could contribute to the evaluation.

**Workshop E2:**

In this workshop, all different stakeholders gathered to present the scores assigned to each of the criteria established in the grid. Following the evaluation method presented, during the final assessment of the options, all parties had to assign a whole number score from 1 to 5 for each criterion. To arrive at a common score for each criterion, each party presented their initial score and the reasons behind it. Based on the perspectives shared by each party, negotiations ensued to reach a consensus score for the discussed criterion. At the end of this workshop, one of the options was voted as the best, with some additional considerations still pending regarding cost-related scores.

After the completion of Workshop E2 and the definitive choice of the best option by the Big Room participants, the involved designers proceeded to develop the options, incorporating the areas defined in the functional program.

**Workshop K3:**

This workshop was conducted with the participation of project users and aimed to organize the functional model for the first-phase building of the complex. To achieve this organization in the most optimized way, we sought to identify synergies among the work of different professors impacted by this project. During this initial workshop, we identified the necessary links between the research topics of the professors, with the goal of favoring research areas that were synergistic and close to each other. In this workshop, the professors also shared their opinions on the strengths and weaknesses of existing facilities, focusing on what they would like to see replicated and any points of concern.

**Workshop K4:**

In Kaizen 4a, the university professors met again to explore the formation of research clusters, identifying synergies between the research of different professors in the department.

From the discussions, four clusters were created with the existing professors (See Figure 3.5), with space for an increase in the number of professors, and a fifth cluster was planned to

accommodate new synergistic research domains that may be added in the future, due to the evolution of the domain.

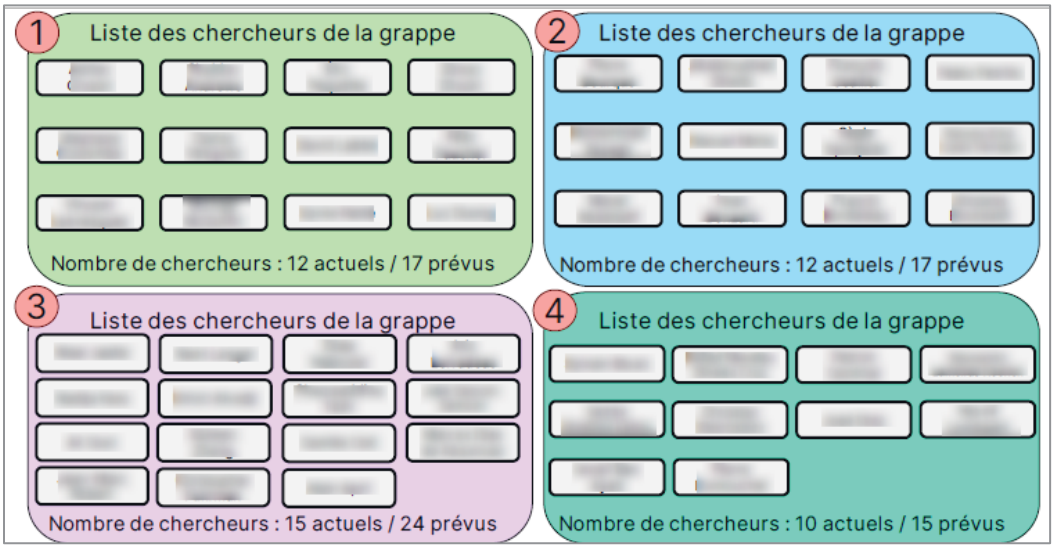


Figure 3.5 Clusters defined by the users during the Kaizen 4a workshop

Based on the information presented above, Atelier 4b focused on identifying which research laboratories needed to be created in the new building and where each of these laboratories would be best located.

The users received the floor plan of the new building, developed by the professionals after the final option was chosen. The professors raised points considered ideal for the proper functioning of the department and sought to allocate a typical organizational block (suggested by the facilitator: See Figure 3.6) and the required laboratories in the spaces, considering their needs and defining the minimum requirements to prevent any unused space.

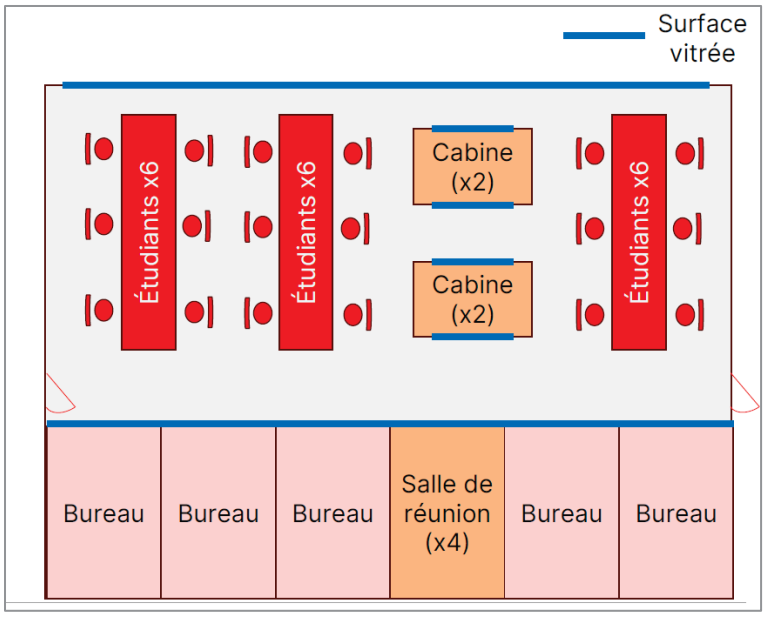


Figure 3.6 Department configuration proposed by facilitator considering users' input

The meeting results were compiled and contributed to the definition of a new program of needs, combining the professors' requirements to promote a collaborative research environment across different areas.

## 3.3 Stakeholders interviews

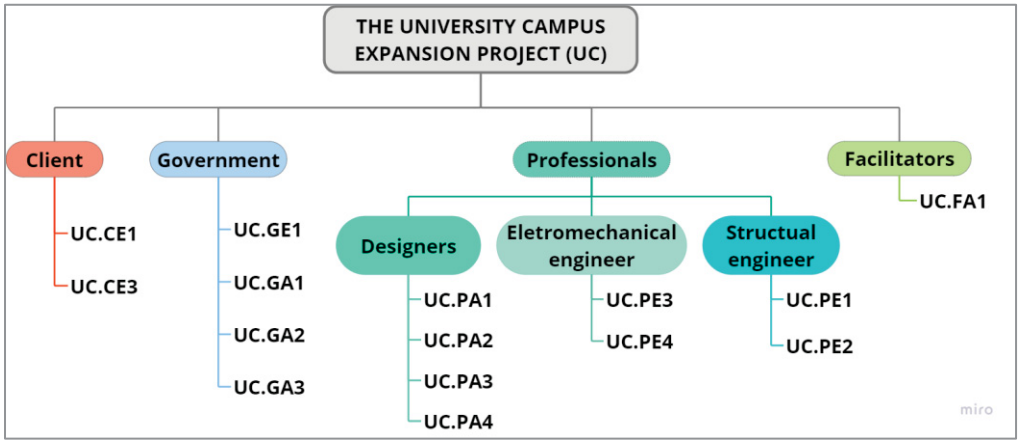


Figure 3.7 The university campus expansion project relation of interviewees

These interviews were carried out by the GRIDD team, with the aim of gathering information on how the IDP is carried out within an environment such as a Big Room. Among the information collected, the information pertinent to this project will be presented in this section.

### 3.3.1 Stakeholders Perspectives on IDP Workshops

The IDP workshops are highly valued by the stakeholders for their ability to promote alignment across various project phases, particularly in complex and multi-phase construction projects. According to **UC.PA2** and **UC.PA3**, the workshops create an environment where the perspectives of architects, engineers, and project managers can converge, enabling a more holistic understanding of project requirements and challenges. They emphasize that these workshops are integral to the overall success of such projects, as they ensure that all disciplines work in sync from the early stages.

However, several participants raised concerns about the rigidity of the facilitation, which sometimes restricted creative exploration. **UC.PA1** and **UC.PA4** suggested that while the workshops foster inclusivity by giving all stakeholders a voice, the structured approach can sometimes feel overly prescriptive, limiting opportunities for spontaneous problem-solving. They recommended introducing smaller, more flexible breakout sessions within the broader workshop framework to encourage free-flowing discussion and ideation.

In contrast, **UC.FA1** noted the importance of maintaining a structured process to prevent chaos and ensure that all critical topics are addressed. The facilitator's role, according to **UC.FA1**, is to balance this structure with enough flexibility to allow participants to explore alternative solutions without feeling constrained. This highlights an ongoing debate about the optimal level of facilitation in IDP workshops, with some stakeholders advocating for a more flexible approach, while others emphasize the need for structure to keep the process on track.

Additionally, participants reflected on the number and duration of workshops. **UC.GA1** questioned whether the number of workshops could be reduced, noting that while they found the workshops valuable, they sometimes felt repetitive, leading to diminishing returns in later sessions. **UC.GE1** acknowledged the benefits of the IDP being flexible allowing the process respond more effectively to evolving needs.

Overall, from the interviews is notable that while IDP workshops are indispensable for stakeholder alignment, there is room for optimizing their structure to balance inclusivity, creativity, and efficiency.

### 3.3.2 Technology and Big Room Environment

The integration of technology in the IDP workshops, particularly in the Big Room environment, has been a focal point for both praise and critique. **UC.PE1** and **UC.PE2** expressed strong appreciation for the use of large screens and 3D visualizations in communicating complex technical challenges. In their experience, these tools enabled clearer cross-disciplinary understanding, particularly when conveying intricate structural and mechanical details. The immersive nature of 3D models, in particular, allowed for real-time visualisation, facilitating immediate feedback from all stakeholders, which significantly enhanced collaboration and decision-making.

However, **UC.PA2** and **UC.PA3** had mixed experiences with digital platforms like Miro. They acknowledged the benefits of being able to visually organize ideas and map out processes but felt that these tools sometimes created a barrier to deeper engagement. They noted that traditional methods, such as physical models and hand-drawn sketches, allowed for a more dynamic and intuitive exchange of ideas. This sentiment was echoed by **UC.PE3**, **UC.PE4**, **UC.CE1** and **UC.CE3** who argued that while digital tools are useful for certain stages of the process, they should complement rather than replace traditional methods.

One key issue raised by multiple participants was the inconsistent integration of technology throughout the workshops. **UC.GA1** pointed out that while the Big Room setup with its large screens and flexible seating arrangement facilitated better interaction, the technology's full potential was often underutilized. For instance, while 3D models were effective in the initial design phases, their use in later stages was more limited, leading to a disconnect between the early visualization and the final design.

Moreover, **UC.FA1** highlighted the challenges of integrating digital tools in hybrid settings, where some participants attended virtually and others in person. This created an imbalance in access to information and engagement levels, as those participating virtually often felt sidelined due to technical limitations. Going forward, participants suggested that more attention should be given to ensuring equal access to technology, both in physical and virtual settings, to maximize the benefits of digital tools in IDP workshops.

### 3.3.3 Virtual vs. In-Person Workshops

The debate between virtual and in-person workshops was a major theme in the interviews, with most participants expressing a clear preference for in-person settings. **UC.GA1**, **UC.GA2**, and **UC.GA3** argued that in-person workshops offer a distinct advantage in fostering human interaction and informal discussions, which are crucial for building trust and rapport among stakeholders. They emphasized that these informal exchanges, which often occur during breaks or after formal sessions, are invaluable for gaining deeper insights into stakeholder concerns and preferences. In their view, virtual workshops, while necessary during the pandemic, lacked this level of engagement.

**UC.PE1** and **UC.PE2** also strongly preferred in-person workshops, noting that the physical presence of stakeholders allowed for more focused discussions and reduced distractions. In virtual settings, participants often struggled to stay fully engaged due to the challenges of

remote work, such as technical difficulties and competing demands on their attention. Moreover, the absence of non-verbal cues in virtual workshops made it harder to gauge the reactions and sentiments of other participants, which is critical for facilitating productive discussions.

In contrast, **UC.FA1** acknowledged the benefits of virtual workshops, particularly in terms of accessibility and convenience. Virtual platforms allowed participants to join from various locations, reducing the logistical challenges of coordinating in-person meetings. However, they also noted that the trade-offs in terms of engagement and collaboration were significant, and that virtual workshops should be used selectively rather than as a complete replacement for in-person sessions.

Interestingly, **UC.PA3** and **UC.PA4** suggested that a hybrid model could be beneficial. By combining the accessibility of virtual workshops with the engagement benefits of in-person sessions, they argued that stakeholders could enjoy the flexibility of remote participation while still benefiting from the collaborative advantages of face-to-face interactions. They proposed that key decision-making workshops should be held in person, while less critical meetings could be conducted virtually to save time and resources.

### 3.3.4 Facilitation and Process Dynamics

Facilitation was universally acknowledged as a critical factor in the success of IDP workshops, with both positive and negative experiences reported. **UC.PA2** and **UC.PA3** appreciated the role of external facilitators in managing the overall process, but they also felt that these facilitators sometimes limited the ability of architects to lead discussions and explore creative solutions. They noted that facilitators often focused on keeping the process on track, which, while important, sometimes stifled deeper exploration of ideas.

**UC.FA1**, who served as a facilitator in several workshops, reflected on the challenges of balancing structure with flexibility. They emphasized that a successful facilitator must create a framework that keeps the process moving forward while allowing enough room for participants to explore alternative solutions. Clear communication and defined roles were highlighted as key strategies for preventing conflicts and ensuring that all participants feel heard.

One of the primary concerns raised by participants was the lack of alignment between the facilitation process and the final decision-making. **UC.GA1** suggested that future workshops could benefit from more dynamic facilitation that better integrates decision-making processes into the workshops themselves, rather than relying on separate decision-making sessions. This would help ensure that the input gathered during the workshops is directly incorporated into the final outcomes, reducing frustration among participants who feel that their contributions are not adequately reflected in the final decisions.

### 3.3.5 Decision-Making and Workshop Structure

The structure of the decision-making process within the workshops was a recurring concern among participants. **UC.PA2 and UC.PA3** expressed frustration with the way the workshops sometimes presented too many options without sufficient filtering, which led to a lack of focus and direction. They suggested that more streamlined processes could help reduce decision fatigue and ensure that the most critical issues receive the necessary attention.

**UC.PE1 and UC.PE2** also called for more specialized sessions, where technical experts could delve deeper into specific issues before presenting their insights to the larger group. They noted that the input from their discipline, was often secondary to architectural and structural concerns. By dedicating more time to these disciplines in focused sessions, they argued, the overall decision-making process could be improved.

**UC.CE1** and **UC.CE3** expressed that the decision-making process often felt rushed, leaving them with insufficient time to thoroughly evaluate and compare different options. They noted feeling pressured to make quick decisions, which was compounded by the time wasted on exploring infeasible options, adding further complexity to the process.

Furthermore, **UC.FA1** pointed out that final decisions were often made outside the workshop setting, which led to frustration among participants who felt that their input was not fully considered. They recommended that future workshops include a clear decision-making component within the session itself, allowing participants to see how their contributions are directly influencing the final outcome.

# CHAPTER 4

# CASE 2: THE HIGH SCHOOL EXPANSION PROJECT

## 4.1 Context

The school project began in 2020 with the initial goal of modernizing an existing school building to align it with the new Quebec Ministry's standards for the next generation of schools.

The Ministry developed a set of guidelines to be followed for the construction of new schools. These directives were crafted with input from an architectural team and consultations with school users. The modernization of the Jacques Leber school aimed to incorporate the Ministry's established guidelines. Consequently, the design workshops were organized with this document in mind, which provided a common vision and outlined the government's objectives and requirements for the school.

Noteworthy aspects of this project include the fact that the building had already been expanded twice, the older part of the structure required significant improvements, and the sports facilities on-site were shared with the surrounding community. Figure 4.1 presents the sequence of workshops conducted throughout the project and Table 4.1 shows the workshops dates and subjects.

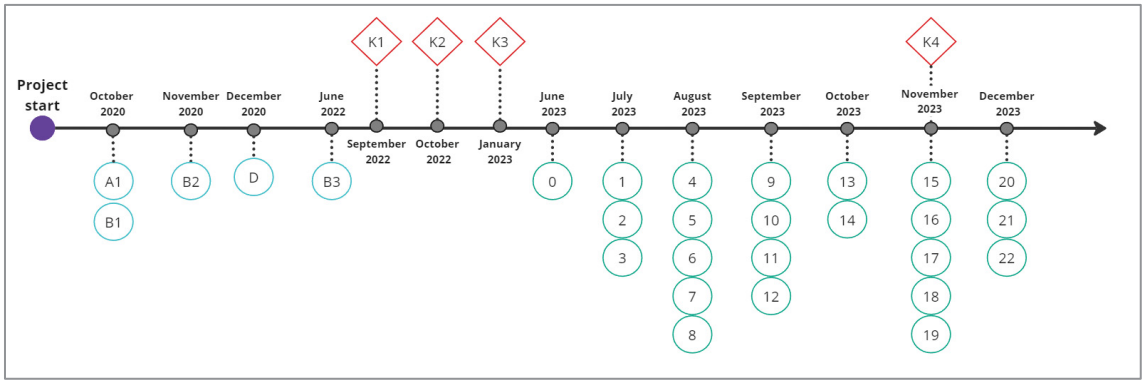


Figure 4.1 The high school project definition and preliminary stages timeline

Table 4.1 The High School Expansion Project workshops dates and subjects

| Workshop | Date | Subject |
|---|---|---|
| A1 | 22/09/2020 | Vision and site |
| B1 | 06/10/2020 | Development of real estate options - Analysis of existing assets |
| B2 | 17/11/2020 | Elaboration of real estate options - Overall project |
| D | 15/12/2020 | Evaluation of promising real estate options |
| B3 | 09/06/2022 | Exploration and confirmation of the new implantation |
| K1 | 24/08/2022 | Circulation around the site |
| K2 | 13/10/2022 | Analysis of functional links |
| K3 | 26/01/2023 | Analysis 90 |
| 0 | 27/06/2023 | Vision, objectives, challenges and risks (introduction to the proposed real estate solution) |
| 1 | 04/07/2023 | Implementation plan (site preparation, civil works and off-site works) |
| 2 | 13/07/2023 | Collaboration assessment |
| | | Discussions on blockages, exchanges and updates |
| 3 | 20/07/2023 | Preliminary workshop - structural concept |
| | | Preliminary workshop - mechanical and electrical concept |
| 4 | 10/08/2023 | Risk workshop |
| 5 | 15/08/2023 | Annex 18 et 19 - Explanation of the process by SQI |
| 6 | 17/08/2023 | Wood structure workshop |
| | | Food services |
| 7 | 24/08/2023 | External location blockages |
| | | Presentation of blockage plans and functional links |
| 8 | 31/08/2023 | Update layout plans and functional links |
| | | Mechanical and electrical progress + Food service discussion |
| 9 | 07/09/2023 | Interior design and site layout presentation |
| | | Scenography and acoustics |
| 10 | 14/09/2023 | Landscaping and volumetric plan |
| | | Urban integration in the presence of the municipality |
| 11 | 21/09/2023 | Materiality of the shell and urban integration update |
| | | Laboratory, documentation and gymnasiums |
| 12 | 28/09/2023 | Sustainable development (LEED certification) |
| | | Presentation of the wood and steel structure |

Table 4.1 The High School Expansion Project workshops dates and subjects (continues)

| Workshop | Date | Subject |
|---|---|---|
| 13 | 19/10/2023 | Concept finalization |
| K4 | 03/11/2023 | BIM Model Presentation |
| | | 30% plan comments and LLD Workshop |
| 15 | 09/11/2023 | Commissioning plan |
| 16 | 16/11/2023 | Presentation of food services and healthy lifestyle workshop |
| | | Presentation of scenography and acoustics |
| 17 | 23/11/2023 | Presentation of the different sectors and Furniture, equipment and tools integration |
| 18 | 28/11/2023 | Legal |
| 19 | 30/11/2023 | Schedule, work phasing, demolition of existing building |
| | | Progress report on Annex 15 deliverables |
| 20 | 07/12/2023 | Legal |
| | | Estimating |
| 21 | 14/12/2023 | Review of development plans |
| 22 | 21/12/2023 | BIM model and virtual visit on plan 50% |
| | | Post-contract collaboration and vision |

## 4.2 Project activities

**Workshop A1:** This IDP workshop, following the process structure, began with an initial presentation on how the process works. This was followed by contextualization about the project to ensure that all participants had the necessary information for the workshop. The focus then shifted to defining a common vision for the project.

With knowledge of the vision expressed in the directive document, the team—composed of professionals, user representatives, and the client—expressed the values they expected to represent with this project, along with their objectives. Participants were divided into subgroups to ensure that everyone had a space to express their opinions.

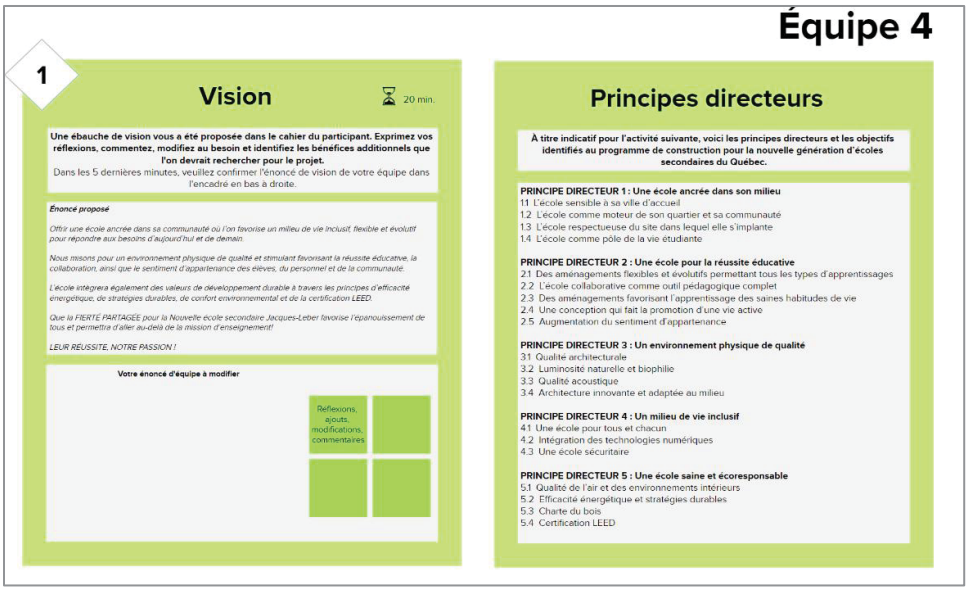


Figure 4.2 Workboard for vision definition provided by facilitator

The vision defined in each subgroup with the use of the workboard (Figure 4.2) was shared with the other participants, there was a concern to ensure that the school can innovate both in terms of construction and pedagogy, requiring a space adapted for this as well as user well-being. Considering these points, the stakeholders established a common vision, considering both the documentation provided by the ministry and their own considerations.

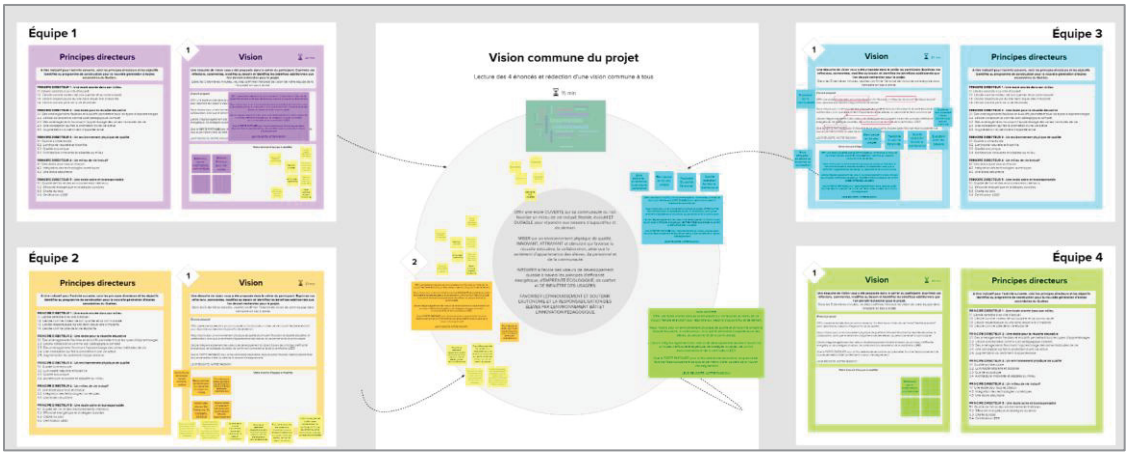


Figure 4.3 Composition of subgroup work in vision definition

During this workshop, most of the reserved time was dedicated to analyzing the site's complexities. The goal was to determine the main challenges for expanding the school, as well as points of attention. This activity was also conducted in subgroups, and the discussed points were subsequently presented to the other participants. Among the points raised are problems related to the adequacy of access to the building, both from a security and logistical point of view for staff and students, lack of parking spaces, and inadequacy of sports and integration facilities.


Figure 4.4 Workboard for strengths identification of the site

Based on these points, the team identified complementary activities that needed to be carried out for project improvement and advancement.

**Workshop B1:** This workshop focused on exploring real estate options. Initially, the existing spaces were observed to identify what should remain in the existing building and which areas

should be transferred to the new portion to be constructed. Two multidisciplinary teams were created, each focusing on a specific discussion topic.


Figure 4.5 Workboard for space allocation provided by facilitator

The results of these discussions were then presented to all participants. The final activity of this workshop involved presenting the preliminary solution for the specific zone implementation, following the demands specified in the directive document provided by the Quebec Education Ministry.

When trying to fit the different locations requested in the functional program, respecting the limitations imposed (e.g., number of floors), the participants realized that the building would have to be greatly expanded, occupying the entire school grounds. The expansion with the required areas and existing limitations become unfeasible. The need for a better definition of priorities and requirements is raised. The information to be collected was identified, which would be provided to the professional team so that they can provide a quality design that meets the requirements in the next workshop.

**Workshop B2:** After Workshop B1, professionals worked on developing five preliminary options with different levels of conservation. These options. were presented to all participants, and they were separated in groups to discuss each option strengths, weaknesses and improvement opportunities.

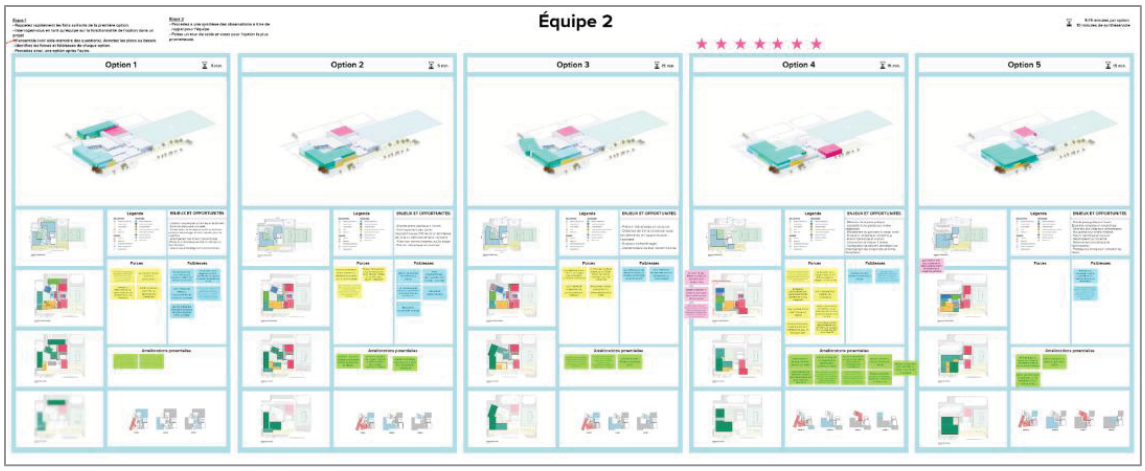


Figure 4.6 Comparison of options made by a subgroup during workshop

The points raised in subgroups were presented to the entire group of participants. The options that delivered the most value, those that required greater demolition of existing parts, had a higher risk of schedule and budget overruns, while the options that presented greater conservation had significant weaknesses in terms of adequacy to the functional program and response to requirements.

Considering these points, promising options were selected for further development. This workshop also included a brief presentation of the option evaluation grid developed by the government agency.

**Workshop D:** Following Workshop B2, the promising options were refined by the professionals. At the beginning of this workshop, these options were presented and evaluated following the recommended notation process for the evaluation grid used in this process. Based on the considerations of each stakeholder group, consensus scores for each option and criterion were established. One option stood out as the best, an option that requires significant demolition. Cost and risk criteria were not evaluated during this workshop and were the responsibility of the government agency to assess.

After this workshop and the evaluation of cost and risk aspects related to option development, the team decided that the cost-benefit of further expanding the school was not favorable. Instead, the construction of a new school was deemed necessary. A process for approving this new proposition was initiated, and the design process was paused during this period, resuming in 2022.

**New Project Phase:**

**Workshop B3:**

After the project pause mentioned above, it was resumed with a workshop dedicated to presenting the new solution, exploring potential options, and confirming the new project implementation. During this workshop, Lean Led Design was introduced to enhance user flow within the project. The facilitator explained the working method to be used for the LLD workshops and the preparatory activities in this context.

Following the workshop plan, professionals presented the options they had already developed for the project—four options with different formats. To evaluate these options, small groups were formed to assess them based on criteria such as mobility and accessibility, functionality and maintenance, integration, impact on the neighborhood, municipal requirements, and construction capacity. Group comments on each option were shared with the other participants, allowing them to add their input. Among the comments there were some issues raised, such as the segregation of green spaces, proximity of the delivery point to the food service area, ease of access to the gym, and the different zones for different users. At this point, the client, including users, could request modifications to the options.

By the end of this workshop, the professionals identified a solution among the proposals that best suited the project's needs, making it the retained solution for further development.

**Workshop K1:**

The first LLD workshop for this project focused on understanding school access for the solution identified as ideal after Workshop B3. At the beginning of the workshop, professionals

presented their initial concept for incorporating functional requirements. The practical part of the workshop involved separating participants into groups to evaluate access for different user types. The assessed factors included community access, visitor and student access, vehicle parking, drop-off zones for school buses and private vehicles, pedestrian and cyclist access, and other outdoor spaces to be shared between the school and the community. From the evaluations, professionals gained insights into access points that did not align with the needs, requiring considerable improvements. Based on these notes an alternative concept was proposed by the Lean team. The team participating in the workshop could then evaluate the concept in question and define future actions necessary for the better development of the concept, including:

- Validation of elements to be shared with the community;
- Validation of the desired number of charging terminals;
- Possibility of firefighter access;
- Study of the circulation of private vehicle drop-off;
- Update of the site plan based on workshop discussions.

Using the information collected, professionals developed new solution propositions to be presented and tested in Workshop K2.

**Workshop K2:** The goal of this workshop was to evaluate user flows within the school, considering the functional program requirements. It was designed based on the functional links defined in the project and existing in the three solutions proposed by the professionals. To ensure a more accurate evaluation of the solutions, 13 typical user trajectories were created to test the efficiency of the defined functional links. These trajectories were developed based on input from students, teachers, technicians, and school administrators.

Table 4.2 Users profiles considered for case 2

| Students' profiles | Teachers' profiles | School staff profiles |
|---|---|---|
| The outdoor enthusiast – sec. 4 | The sporty math teacher | The associate director |
| the newcomer - sec. 1 | The coach | The laboratory technician |
| the student with reduced mobility - sec. 3 | The involved art teacher | The "cool" special education technician |
| the graduate - sec. 5 | | The recreation technician |
| the unruly student - sec. 2 | | |
| The hard-working student - sec. 3 | | |

In the practical stage, participants were divided into groups. Using a 3D model and colored yarn (Figure 4.7), they simulated the trajectories of different users for two of the presented options (one in a T format and the other in an H format).

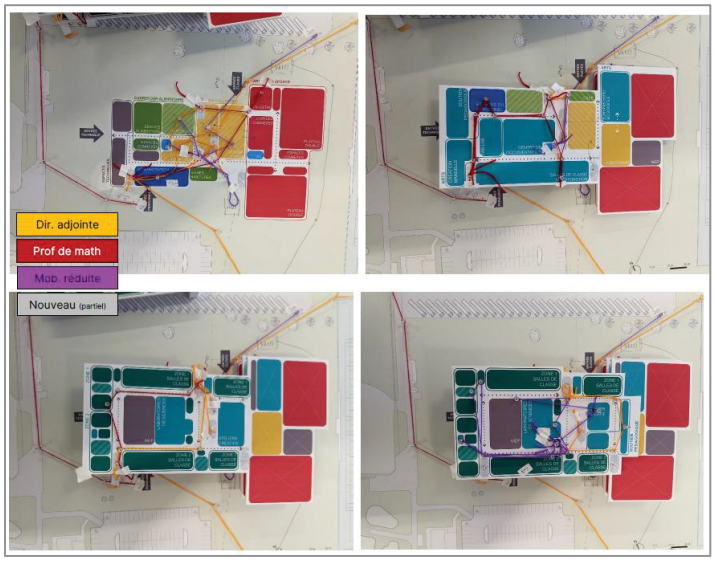


Figure 4.7 Trajectories simulation during Lean Led Design workshop

The H-shaped option was judged the best one in view of the observations made about external circulation, logistic systems, and restrictions. The option was kept as the one to be improved in the next project stages.

The simulation of trajectories also allowed the collection of relevant information for improving the links between different areas. The collected data was used to create a functional link matrix adapted to the specific project. This matrix will continue to guide professionals throughout the design process, ensuring precise concept improvement.

**Workshop K3:**

In this workshop, multiple simulated trajectories in the improved solution were presented. Based on these simulations, the workshop participants presented new findings and improvement proposals.

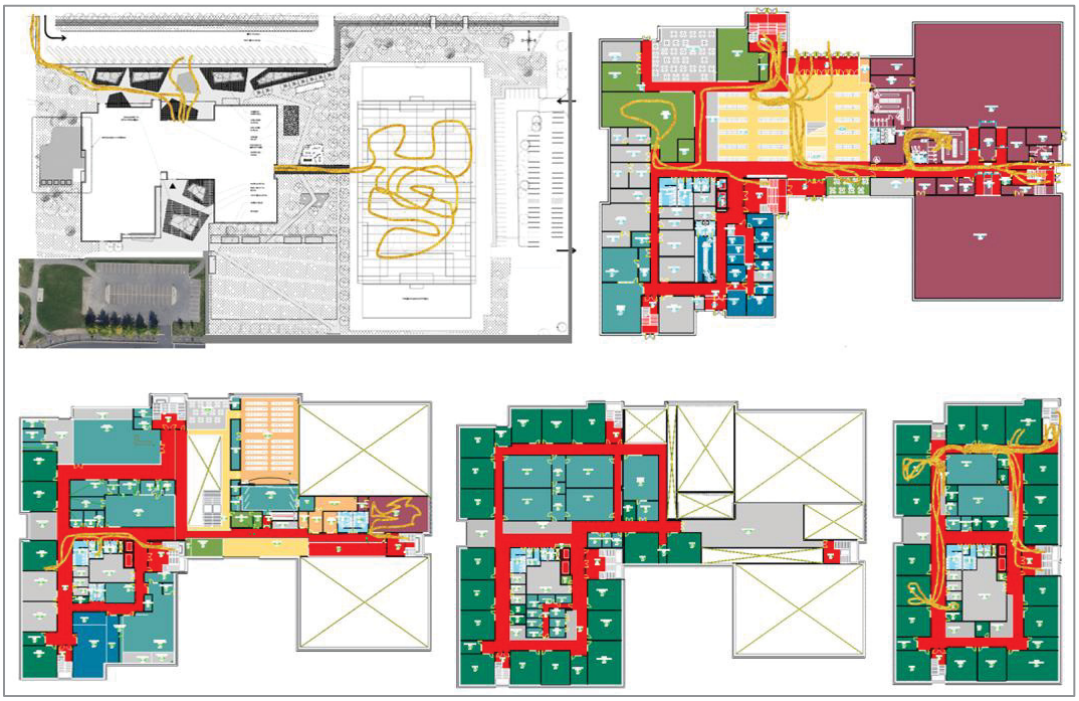

Figure 4.8 Exterior access and 1st to 4th floor trajectory simulations for one student profile flow

Among the findings are the waste of space due to the existence of corridors and useless spaces, as well as the possibility of improving the positioning of some entrances to ensure the safety of certain areas and ease of access for different audiences, thus improving the flow within the school. These findings were validated with the professionals to create a more comprehensive request for proposals, providing clear requirements for the selected team to develop.

The proposed solution was also evaluated in terms of compliance with the functional link matrix. Links not adhered to by the proposition were highlighted, and participants were encouraged to present solution ideas and considerations regarding the importance of each link. This ensured better alignment of the matrix with the project's needs.

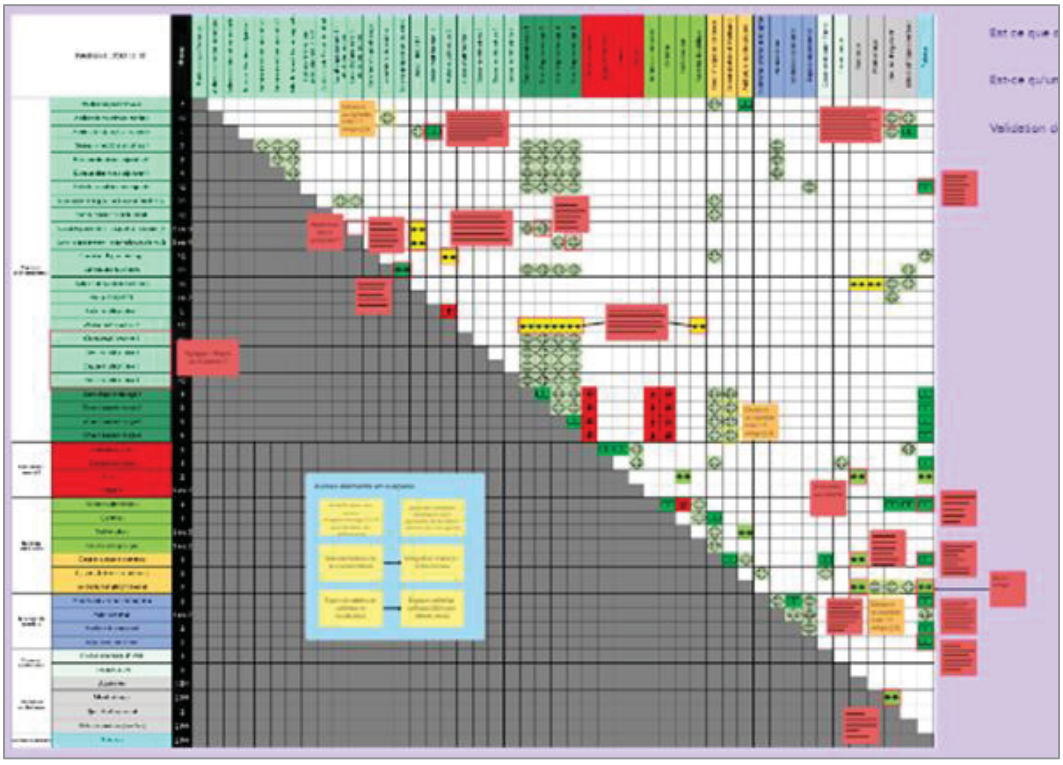

Figure 4.9 Example of a functional links matrix worked on during the workshop

During the construction team selection process, the IDP and LLD workshops were paused, resuming approximately six months later. The IDP workshops resumed in June 2023, beginning by leveling the entire team on project's vision and values. The design development

continued, considering the information provided by the professionals. Workshops 1 to 22 had specific themes as presented in Table 4.1 and were conducted weekly in the Big Room. In addition to the key stakeholders present in all workshops, other professionals were invited to provide important information related to each workshop's theme.

**Workshop K4:**

The last LLD workshop was attended by key project stakeholders and aimed to validate the concept developed by the professionals. Participants were divided into groups to reevaluate the solution's adaptation to specific trajectories. During this activity, participants identified areas for improvement and issues to be resolved before the construction phase.

A review of the functional link matrix was conducted to ensure that all requirements were being met by the solution.

## 4.3 Stakeholders Interviews

Interviews were held with the professionals involved in the project in order to understand each stakeholder's view of the process. The considerations of each party are detailed below:

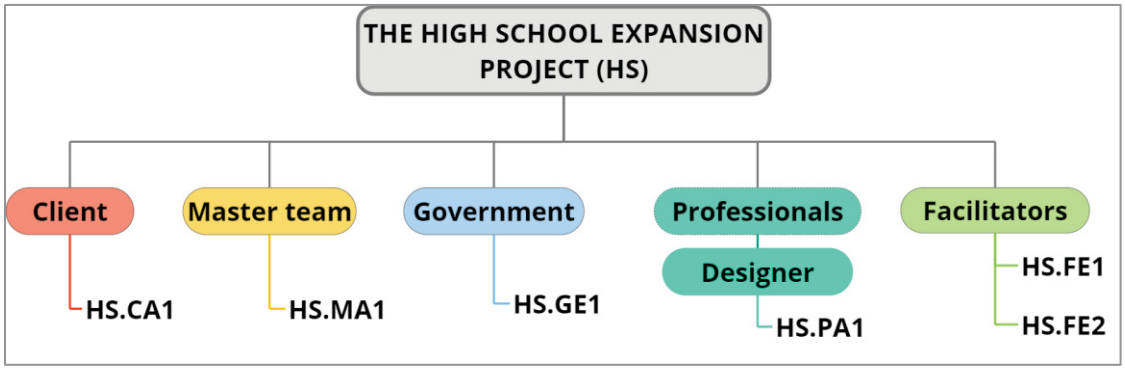


Figure 4.10 The high school expansion project relation of interviewees

### 4.3.1 Stakeholders' Perspectives on IDP Workshops

The IDP workshops were essential in fostering collaboration among various stakeholder groups in the early stages of the project. However, the responses to the workshops differed significantly depending on the stakeholder's background and role.

**HS.FE1** emphasized the strategic importance of the Integrated Design Process in facilitating early-stage alignment among key stakeholders. The primary objective of the workshops was to synchronize the project's overarching vision with the specific needs of its end-users. According to **HS.FE1**, the role of the IDP was to focus on high-level planning, addressing critical aspects such as site constraints, circulation flows, and functional requirements. This approach ensured that early decisions were informed by both practical limitations and the operational needs of the future occupants, fostering a shared understanding among all parties involved.

**HS.GE1** conveyed frustration with the insufficient technical depth observed in most IDP projects they had participated in. They felt that the IDP discussions, while useful for high-level conceptual alignment, left the process incomplete. In their view, the IDP workshops were overly abstract, focusing primarily on broad concepts without providing the concrete guidance necessary for advancing the technical design. For **HS.GE1**, these sessions often felt like "kumbaya" moments, where ideas were exchanged but failed to result in significant progress toward practical, actionable design solutions.

Similarly, **HS.MA1** found that while the IDP workshops were beneficial in establishing a broad understanding of the project's objectives, they were insufficient for addressing the detailed design elements that the professionals needed. The general nature of the workshops left room for misinterpretation and misalignment between the professionals' designs and the client's needs.

**HS.CA1** noted that the structured approach of the IDP workshops fostered effective collaboration among the various project teams. However, while this collaborative environment was largely successful, the interviewee acknowledged certain challenges arising from differing approaches and priorities.

**HS.PA1** observed that the early involvement of all disciplines, including architects and engineers, facilitated a seamless and integrated workflow, significantly enhancing the efficiency of the project process. The IDP mandated the simultaneous collaboration of all consultants, fostering a more cohesive approach to design. This integrated methodology proved particularly beneficial given the project's tight timeline, as it allowed for quicker decision-making and minimized delays typically caused by fragmented, sequential workflows.

### 4.3.2 Project Challenges

The project encountered numerous challenges that impacted both its progress and outcomes. Leadership changes, budget constraints, and delays in decision-making created significant roadblocks throughout the process.

**HS.FE1** emphasized the role of leadership instability in causing confusion and delays. Frequent changes in project leadership meant that decisions were often revisited or delayed, which resulted in frustration among stakeholders. The lack of a clear project leader who could make decisive choices slowed the project considerably.

Budgetary issues were another major challenge. **HS.GE1** noted that the project faced tight financial constraints, which affected design choices. The allocated budget often did not match the scope of the project, forcing the team to make compromises. This misalignment between available resources and design ambitions led to a prioritization of certain elements while sacrificing others. This sentiment was echoed by **HS.MA1**, who also highlighted the time pressure imposed on the project. The tight deadlines prevented the team from fully exploring and refining design options, further exacerbating the challenges.

In addition to budgetary and time constraints, **HS.CA1** pointed out the difficulties posed by strict spatial requirements imposed by the ministry. These limitations required continuous rationalization, as the team struggled to fit the project's ambitions within the available space and resources. **HS.FE2** added that the late introduction of Lean Design into the process caused friction, as stakeholders were resistant to revisiting decisions that had already been made during the IDP phase.

Moreover, the decision to shift the project from a traditional design approach to a more progressive, step-by-step construction model added complexity. This change came late in the process, which meant that many plans had to be revised or abandoned, leading to further delays.

Despite these challenges, stakeholders managed to adapt to the evolving project demands. However, the leadership changes and the misalignment between budget, design, and timelines continued to impact the project throughout its development.

### 4.3.3 Stakeholders' Perspectives on Lean -Led-Design Workshops

Lean Led Design workshops, introduced later in the project, were met with a variety of reactions from stakeholders. These workshops aimed to refine the project's design by focusing on optimizing space functionality and improving the flow of circulation.

**HS.FE1** noted that while Lean Design created initial confusion among stakeholders, it was eventually appreciated for its detailed, granular approach. Unlike the broader IDP workshops, Lean Design delved deeper into the specifics of space functionality and circulation. However, for a relatively straightforward project like a school expansion, some stakeholders felt that the level of detail provided by Lean Design might have been excessive.

**HS.GE1** mentioned that the Lean Design was introduced to address specific challenges that had emerged during the project, particularly the need for a more structured approach to internal

circulation, space usage, and overall efficiency. Drawing from lessons learned in previous projects, where a lack of early, organized planning led to costly changes and inefficiencies, Lean Design aimed to optimize the school's layout for all users, including teachers, administrative staff, and students with disabilities. Despite these clear objectives, **HS.GE1** noted initial skepticism, especially from architects who felt the workshops were redundant, as the Integrated Design Process had already set the project's direction. Over time, however, the architects recognized that Lean Design provided valuable, concrete guidance on addressing functional issues and helped prevent potential rework later in the process.

For **HS.MA1**, Lean Design was a valuable addition to the project, offering a more focused and detailed approach than the earlier IDP workshops. Lean Design helped address the functional and spatial requirements that had been left unresolved in the initial design phase. **HS.CA1** also appreciated Lean Design for its focus on functionality, though she felt that the rigidity of some of the methodology tools stifled partially the creativity and flexibility that the project required.

However, **HS.FE2** mentioned that the late introduction of Lean Design created challenges, as it disrupted the workflows of professionals who had already invested significant time in the project. The workshops revealed issues with functional links and circulation that had not been previously considered, but this also meant that earlier decisions had to be revisited, causing delays.

**HS.PA1** expressed concerns about how Lean Design differed from IDP, particularly in terms of design optimization. Although by the moment of the interview **HS.PA1** had yet to participate in a LLD workshop, she anticipated that the process would focus more on refining the design rather than introducing entirely new ideas, what in their understanding is similar to the IDP objectives.

### 4.3.4 Integration of Lean -Led-Design and IDP Methodologies

The integration of Lean Design and IDP methodologies proved to be a complex yet beneficial process. While both methodologies brought unique advantages to the project, their integration was not without challenges.

**HS.FE1** noted that the integration of Lean Design with IDP was complementary in theory but difficult to implement due to changes in project leadership and shifting priorities. The two methodologies offered different strengths, with IDP focusing on high-level alignment and Lean Design providing detailed refinement. However, the project struggled to fully realize the benefits of integrating these processes due to external constraints.

**HS.GE1** described Lean Design as a validation tool for the concepts developed during the IDP phase. Initially, IDP workshops were broad, covering general project needs and stakeholder expectations. When Lean Design was introduced, it built upon these discussions, refining the high-level concepts into more actionable, user-oriented solutions.

For **HS.MA1**, the integration of Lean Design and IDP was essential to the project's success. The two methodologies were seen as complementary, with IDP setting the strategic direction and Lean Design refining that strategy into concrete, functional plans. However, **HS.CA1** mentioned that the rigid design matrix used in Lean Design limited the flexibility needed for certain aspects of the project, creating tension between innovation and structure.

Late integration of Lean Design posed additional challenges. **HS.FE2** pointed out that introducing Lean Design after many design decisions had already been made caused friction between the teams, as they had to revisit earlier choices. Despite these challenges, the combined use of IDP and Lean Design methodologies allowed the project to benefit from both high-level stakeholder alignment and detailed functional optimization.

### 4.3.5 Facilitation Process

The facilitation process was a critical component in managing the complexities of the project, particularly as the team navigated the integration of IDP and Lean Design methodologies.

**HS.FE1** noted that facilitators had to constantly adapt to changes in leadership and project demands. Despite these challenges, the facilitators succeeded in engaging key stakeholders throughout the design process. They focused on assuring that all voices, including those of educators and administrators, were heard and incorporated into the final design.

**HS.GE1** emphasized the role of facilitators in helping stakeholders understand and appreciate the value of Lean Design. Initially, some stakeholders were resistant to the idea of introducing another methodology, especially after the extensive IDP workshops. However, facilitators played a key role in demonstrating how Lean Design could refine the project, providing structured, data-driven insights that helped guide the design process.

**HS.MA1** commended the facilitation process for its effective use of visual aids, such as spatial matrices, which played a crucial role in helping stakeholders—particularly those less familiar with design principles—grasp the technical aspects of the project. These tools enhanced engagement by allowing non-professional stakeholders to actively participate in the design process, thereby fostering a more inclusive and collaborative environment. Similarly, **HS.CA1** highlighted the value of practical flow simulation tools, brought by the Lean facilitator, noting that they significantly improved stakeholders' understanding of the project's functional needs and helped align client expectations with the technical requirements.

Overall, the facilitators played a crucial role in ensuring that the project stayed on track, despite the challenges posed by leadership changes, tight deadlines, and the integration of two complex methodologies.

### 4.3.6 Process Benefits

Despite the challenges faced throughout the project, both the IDP and Lean Design processes provided clear benefits to the overall design and execution.

**HS.FE1** noted that the IDP workshops were successful in aligning the diverse group of stakeholders early in the project. This initial alignment was crucial for ensuring that everyone, from architects to educators, had a shared understanding of the project's objectives. Lean Design then built upon this foundation, refining the spatial and functional aspects of the project.

**HS.GE1** emphasized the value of Lean Design in reducing inefficiencies and minimizing costly redesigns. By introducing Lean Design after the IDP phase, the team was able to address functional issues early on, reducing the need for rework later in the project.

**HS.MA1** highlighted that the combination of IDP and Lean Design allowed for clearer decision-making and better stakeholder alignment. IDP helped set the strategic direction for the project, while Lean Design provided the detailed data necessary for making informed decisions about space functionality and circulation.

**HS.CA1** mentioned that Lean Design's use of simulations allowed the team to anticipate and address potential problems early in the design phase. However, she also noted that the rigid design matrix imposed by Lean Design sometimes limited flexibility, which was a drawback for a project that required adaptability.

**HS.FE2** acknowledged that Lean Design, though introduced late, helped clarify functional relationships and user needs, ultimately improving the overall design. **HS.PA1** expressed optimism that Lean Design would further optimize the functional aspects of the project, building on the collaborative foundation established during the IDP phase.

### 4.3.7 Decision-Making

The decision-making process throughout the project was influenced by both the IDP and Lean Led Design methodologies. **HS.FE1** expressed frustration with the frequent leadership changes, which often resulted in delays in critical decisions. The absence of decisive leadership led to a lack of clarity on key issues, frustrating stakeholders who were eager to move forward.

**HS.GE1** pointed out that Lean Design played a crucial role in guiding the decision-making process, particularly by providing the structured data necessary for evaluating design options. This data allowed stakeholders to make more informed decisions, reducing the likelihood of costly mistakes later in the project.

For **HS.MA1**, decision-making improved during the Lean Design phase due to the detailed data and visual tools that helped stakeholders understand the spatial relationships and functional needs of the project. However, ongoing discussions and disagreements between stakeholders sometimes slowed down the decision-making process.

**HS.CA1** mentioned that the design matrix, while helpful in guiding decisions, sometimes imposed too much rigidity on the process. This rigidity slowed down innovation and created tension between the need for structured decision-making and the desire for more creative solutions. **HS.PA1** noted that the IDP framework promoted efficient decision-making early in the project, though the tight timeline raised concerns about the quality of those decisions.

# CHAPTER 5

# RESULTS: THE EXPLORATION OF VALUE IN THE EXISTING PROCESSES

This chapter presents the analysis of the case studies and interviews conducted with professionals experienced in TVD. These analyses aim to identify the challenges encountered in highly complex projects and explore potential solutions to address these challenges.

## 5.1 Case analysis

The cases were analyzed based on criteria considered relevant to the development of this thesis. The criteria considered were focus on value, collaboration, decision-making, stakeholders' acceptance, user participation, project process and integration of methodologies.
The analysis of each of the cases in each criteria is presented in the following sections.

### 5.1.1 Focus on value

For the first case studied, in the workshops K1a, K1b, K2, A1, and A2, there was a higher emphasis on value compared to the other sessions in this IDP project. These particular workshops were specifically focused on capturing stakeholder values.

Workshops K1 and K2 involved participation from users, including professors and representatives of the students, alongside Lean facilitators. During these sessions, each party presented their requirements, which had been defined with the assistance of users from their respective departments. The criteria presented were deemed essential based on their perspectives and experiences, encompassing both aspirational and functional dimensions.

Among the functional aspects identified were the need for increased spaces to accommodate a growing number of students and professors, as well as the need for adaptable spaces to foster

better interaction among faculty, students, and researchers, along with integration across various research initiatives.

The inclusion of student representatives in these workshops can provide valuable insights into their spatial needs. Although the students articulated their demands during K1 and K2 workshops, feedback from the meetings indicated the preparation of students was not at the expected level to effectively define their needs so it aligns with the professionals' capacity to deliver such solutions.

Regarding workshops A1 and A2, the focus was on enhancing professionals' understanding of the values articulated by users in K1 and K2, as well as their comprehension of the site context. In these workshops, the facilitator presented the defined values and stakeholders engaged in discussions to create a shared vision that aligned their objectives with those of the users.

However, the limited information available regarding these workshops restricts our ability to draw comprehensive conclusions about their structure and outcomes. It is noteworthy that simply presenting the values defined by users can impose limitations, as it requires an interpretation by facilitators and professionals who were not involved in the user’s value definition process.

Subsequent workshops, while still addressing factors contributing to the project's added value, did not delve as deeply into user requirements, instead focusing on other site complexities. In technical workshops, the value aspects that emerged included the historical heritage of the sites, challenges related to the functional program, urban integration, and sustainable development. In other workshops, the development of options aimed to generate value for the final project, concentrating specifically on the requirements outlined in the functional program.

The Figure 5.1 presents the word clouds generated from workshops T1 to E2. This visualization highlights the distinct focuses of each session. Notably, considerations regarding project value (“valeur” in french) and user requirements (“besoins” in french) are prominently

emphasized in the technical workshop T1 and are revisited in workshop T5. In contrast, the subsequent workshops predominantly concentrated on risks and the functional program.

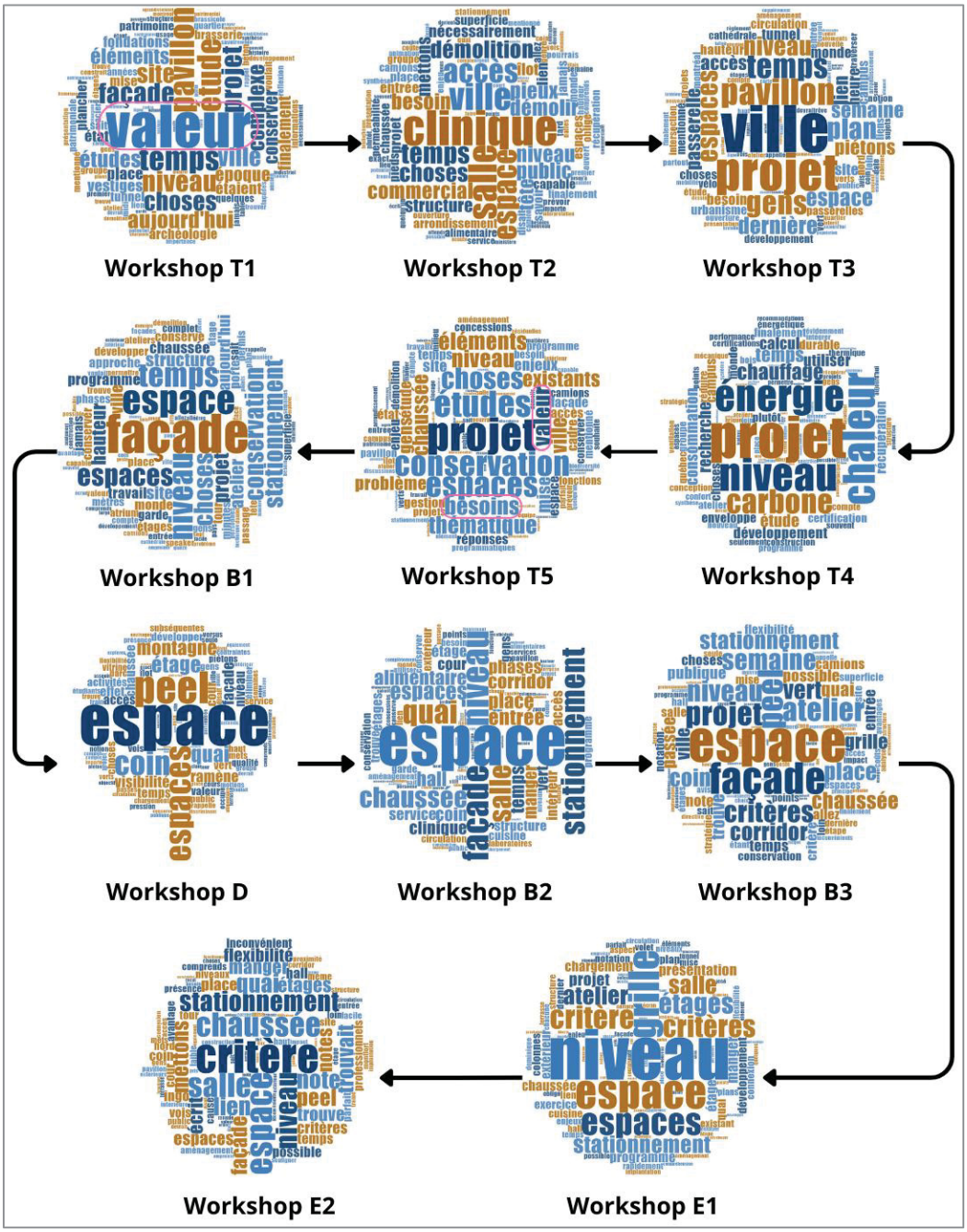


Figure 5.1 Word cloud from case 1 workshops discussion

Finally, workshop K4 revisited the user-defined values, exploring synergies among different departments and considering faculty insights regarding the layout of the new building's premises.

A comparison between faculty considerations and the final proposal from designers revealed a misalignment between expectations and the proposed solutions for case 1 (see Table 5.1). This indicates that the structure employed in conducting the IDP in parallel with the LLD workshops does not necessarily produce a fit-for-use project, thereby necessitating greater user participation throughout the entire process.

Table 5.1 Users needs and professionals proposed solution for case1

| | **Professors** | **Professionals** |
|---|---|---|
| **Separation between floors** | Floors separated by clusters - with professors, students, and laboratories together | Floor separation by usage |
| **Meeting space** | Varied offer expected →Space that can accommodate 2 people →Space that can accommodate 4 people →Space that can accommodate 8 people | 1 large meeting room planned on the 2nd floor |
| | At least 3 rooms for 8 people with an external view spread over 6 floors | |
| | Meeting space (x4 people) near (1x / 5 offices) | |
| **Professors' offices** | 2 to 5 professors' offices contiguous with the students' open office spaces | Office spaces concentrated at the center of the area, without an external view |

Table 5.1 Users needs and professionals proposed solution for case1 (continues)

| | **Professors** | **Professionals** |
|---|---|---|
| **Student offices** | Students' open office spaces with external views (in blocks of 6 to 18 offices) - max 2 office blocks side by side - noise reduction | Students' area limited and concentrated on the 2nd and 3rd floors - without proximity to professors |
| **Laboratories** | Alternating with multipurpose and/or specialized laboratories - facilitating permeability between environments and proximity of work and experimentation spaces | Laboratories concentrated on the upper floors - possibly far from the workspaces of some professors and students |
| | 2 multipurpose laboratories per cluster | No mention of laboratory type by floor |
| **Storage spaces** | 1 small one in each specialized laboratory | 1 storage room planned on the 3rd floor - far from most laboratories |
| | 2 around the multipurpose laboratories | |
| **Technicians' offices** | Inclusion of an office for technicians | No mention of the technicians' office |
| **Printing and copying room** | 1x printing and copying room per floor | No mention |
| **Kitchen/Café area** | Interest in having a small relaxation area | No mention except for a kitchen on the 2nd floor |

In the second case studied, the concept of value was highlighted in the project guidelines (stablished by the Ministry of Education) from the project's inception, as it aimed to modernize existing schools to support new pedagogical strategies. The documentation provided by the

Ministry of Education outlines the minimum requirements for developing new schools in the province and was developed with input from school administrators, principals, service providers, and teachers.

Figure 5.2 Workshop for the requirement document preparation
Taken from Consortium Lemay, SQI, & MEES (2020, p. 14)

The documentation clearly defines the users of secondary school projects, placing a special emphasis on students while also considering teaching staff, non-teaching staff, administrative staff, other school service center personnel, parents or guardians, municipality representatives, citizens, and occasional users who may access the school. Consequently, for the high school expansion project, professionals were brought in with the understanding that one of the objectives was to deliver a design that responded to the value sought by the school.

To adapt the requirements defined in the documentation to the specific needs of the school, representatives of the user groups participated in the workshops, contributing both to refining the initial project requirements and to updating the project's needs during the Integrated Design Process. The LLD workshops further contributed to delivering a value-driven project by empowering user representatives, emphasizing the importance of their involvement in developing solutions. These workshops provided tools that heightened participants' awareness of the project's real needs, considering both the general requirements for new schools and the unique aspects of this specific project.

The focus on value within the IDP workshops also reflects the collaborative efforts of stakeholders, including architects, educators, and administrators, who were instrumental in refining project objectives and addressing functional needs. Initial workshops established a common vision emphasizing user well-being, inclusivity, and adaptability in design. As participants engaged in defining priorities, they uncovered challenges related to site logistics, safety, and accessibility, prompting the development of actionable solutions. The integration of Lean Design methodology further enhanced this value-driven approach by offering structured analyses of spatial relationships and functional links. Despite initial skepticism about the necessity of these workshops, stakeholders ultimately recognized their role in aligning diverse perspectives and optimizing design outcomes. This iterative process not only addressed immediate project needs but also fostered a shared sense of ownership among participants, reinforcing the importance of user-centric design in educational environments

### 5.1.2 Collaboration

The reviewed literature identifies IDP, Kaizen and LLD workshops as significant facilitators of collaboration, a perspective substantiated by direct observations from these sessions. These workshops emerged as crucial platforms for stakeholders, including clients, designers, and end users, to articulate their needs and expectations, ultimately fostering a shared vision that guided project development.

In Case 1, the Kaizen workshops allowed professors and students to present their viewpoints in an inclusive environment. With the facilitator's guidance, participants engaged in mixed groups to identify their requirements and co-develop solutions. The facilitator played a vital role in structuring the meetings, introducing various tools to facilitate discussions, and synthesizing dialogue to ensure a clear understanding among all participants. As a result, most of the workshop time was dedicated to interactive participant engagement, which aligned with the methodological requirements of participatory design.

Further observations from the IDP workshops in Case 1 indicated that while the relationships among stakeholders facilitated meaningful discussions and the proposal of solutions, these interactions were heavily reliant on facilitator input. The Big Room sessions, in particular, featured extensive presentations from both professionals and facilitators, which were interspersed with collaborative interactions among participants (See Figure 5.3).

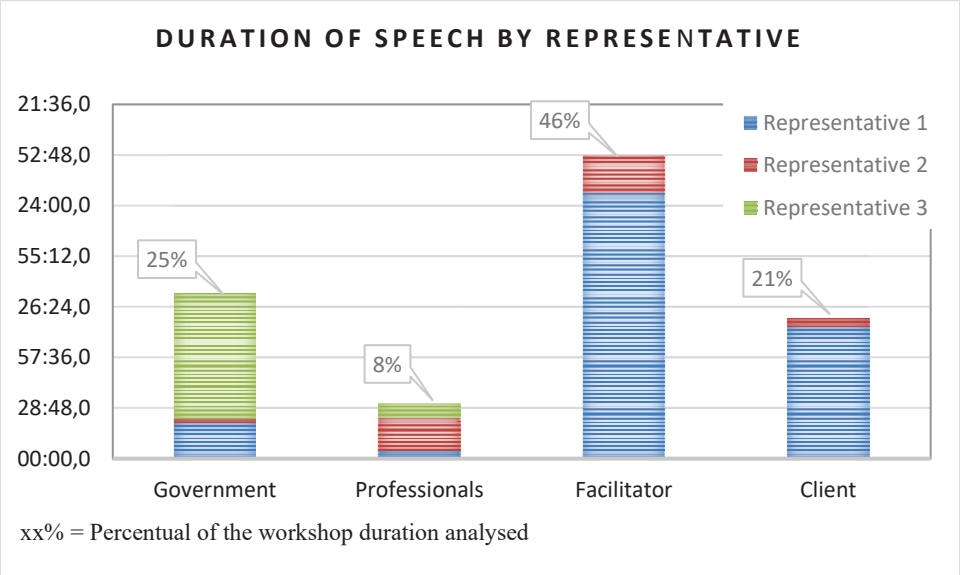


Figure 5.3 Analysis of the participation on workshop E2

Stakeholders interviewed from Case 1 noted that the collaborative dynamics among participants were fluid and productive, enabling the workshop objectives to be met without significant complications. However, several challenges were identified, including communication barriers and the need for more structured facilitation. Some participants mentioned that while technology had been crucial during the pandemic for maintaining engagement, it also posed challenges in face-to-face meetings. The dependence on a single person interacting with screens during in-person workshops limited overall engagement and the opportunity for more dynamic, spontaneous discussions.

In Case 2, the collaborative environments established through IDP and LLD workshops facilitated a shared vision among participants, which was essential for navigating the

complexities of the project site and addressing the functional program requirements. These workshops not only encouraged stakeholder interaction but also allowed for the incorporation of diverse perspectives, enhancing the project's overall design quality.

However, the structure of these workshops, while generally effective, occasionally led to process fatigue among participants, particularly when sessions were perceived as excessively lengthy or repetitive. This observation suggests a pressing need for more dynamic and flexible workshop formats to sustain participant engagement and enhance the decision-making process.

The iterative nature of the workshops, as demonstrated in the Jacques Leber project, allowed for continuous refinement of project designs based on participant feedback. This iterative process underscored the necessity for ongoing communication and coordination among stakeholders to prevent misalignment in expectations and ensure that the evolving project requirements were met. Overall, the findings from both case studies illustrate that effective collaboration, facilitated through structured workshops, is essential for fostering a shared understanding among participants, thereby enhancing the likelihood of project success.

### 5.1.3 Decision making

Regarding decision-making, there is a notable divergence in the perspectives of various stakeholders. Government representatives assert that the process enhanced decision-making efficiency. In contrast, professionals and client representatives expressed that, from their viewpoint, actual decisions were not made during the workshops. They felt isolated from the decision-making process and perceived that their influence over the final outcomes was limited. This divergence highlights how the individual objectives and perceptions of each party can significantly affect their views on the overall process.

In workshop B1, professionals presented real estate solutions based on discussions from previous sessions. To facilitate the comparison of options, they established criteria related to

some of the value-generation topics discussed in workshops A1 and A2, including program criteria, urban criteria and sustainable development criteria:

Based on the exploration of options and their evaluation against the aforementioned criteria, certain options were selected for further exploration. Some participants regarded this selection process as a decision-making moment; however, others did not view it as such. For those participants, the actual decision-making would occur in workshop E2, where the final solution would be chosen based on various criteria outlined in the evaluation grid, which had been defined by the stakeholders.

A comparison of the criteria utilized in these two workshops reveals that the criteria employed in the selection of options in workshops B1 and B3 do not necessarily align with those in the evaluation grid of workshop E2. Several interviewed professionals deemed this disconnect detrimental to the project, as certain options were rejected based on criteria that were not considered relevant when completing the final selection grid.

Finally, the sense of lacking decision-making power expressed by some participants may be linked to the perception that decisions were made in the pilot committee workshops and communicated to the other participants during the sessions. Others felt a lack of decision-making authority related to the evaluation grid, which required input from individuals external to the workshop regarding risk and cost criteria. Consequently, one participant with decision-making power was not present during this critical process.

In the second case studied the decision-making process was help predominantly during meetings in the Big Room, where the presence of participants with decision-making authority was essential for ensuring agility in the process. Stakeholders initially experienced frustration from frequent leadership changes, which led to delays in critical decisions and confusion among team members.

However, the active involvement of user representatives during the workshops allowed for the efficient validation of proposed solutions, significantly reducing rework. When certain decisions required validation from external members, participants created strategies to obtain these approvals and monitored the status of these decisions at each workshop, maintaining precise control to avoid project delays.

The introduction of Lean Led Design enhanced the decision-making process by providing structured frameworks, concrete data, and visual tools to guide evaluations of design options. This approach enabled stakeholders to make more informed choices and minimized the risk of costly mistakes. While the IDP workshops laid the groundwork for strategic directions, the LLD workshops refined these concepts, ensuring that decisions were firmly grounded in user needs and functional requirements.

Nonetheless, the structured nature of Lean Design sometimes imposed rigidity, which could limit creativity and slow innovation. Overall, the combined decision-making framework proved beneficial, but the timing of Lean Design's integration and the effectiveness of facilitation were crucial in navigating the complexities and achieving successful project outcomes.

### 5.1.4 Stakeholders' acceptance

In the context of Case 1, stakeholders appeared to agree on the use of the methodology throughout the process. Observations confirmed this perception, as the atmosphere during the meetings was relaxed. When questioned, participants expressed satisfaction with the process and recognized its benefits for collaboration. Similarly, the professors involved in the Kaizen workshops seemed content with the process; they actively engaged in discussions and were open to proposing improvements and adapting to changes.

Despite the high level of acceptance among stakeholders during the process, their adaptation to the new methodologies proved to be more challenging. As previously mentioned, the IDP

process faced several communication challenges. Although the Big Room environment facilitated transparency, participants experienced difficulties in moving away from established practices within the construction domain, which were often characterized by siloed work and a lack of trust. These challenges added complexity to the decision-making process, as participants felt they lacked complete information or that their opinions and suggestions might not be considered by others.

An additional challenge was observed during the Kaizen workshops. Participating professors exhibited skepticism regarding the value of their contributions. The project coordinator encountered difficulties in engaging faculty members, as they believed that the lengthy process would not substantially benefit the final project. Many professors felt that by the time solutions were finalized, they would have already left the school, rendering their input less impactful. Although a significant number of professors participated, the process could have been further enhanced if they had received better preparation at the outset and ongoing support throughout the entire process.

In the second case study, initial skepticism prevailed among certain professionals, particularly architects, regarding the necessity and effectiveness of the Lean Design methodology workshops. This resistance stemmed from the workshops' late integration into the project timeline and a lack of clear communication regarding their purpose and anticipated benefits. However, as participants became more actively engaged in the workshop discussions, their skepticism gradually shifted to a recognition of the value these workshops provided. The tools and structured discussions facilitated a shared understanding of the project's vision and fostered opportunities for value improvement, thereby offering a more focused approach to validating and refining design solutions.

Additionally, some participants expressed concerns about the organization of the workshops, noting that they required extra preparation on their part, which left limited time for actual project development. This perception can contribute to challenges in accepting the use of IDP, highlighting the need for a well-structured process that supports professionals. It is essential

that the purpose and benefits of the workshops be effectively communicated to these stakeholders, enabling them to contribute meaningfully to the structure of the process. When adequately supported, these workshops can enhance collaboration rather than impose additional constraints on the design work.

### 5.1.5 User Participation

The importance of user participation in the project development process is highlighted through two distinct case studies, revealing its pivotal role in aligning project objectives with the actual needs and expectations of both clients and end users. In the first case, user inclusion was systematically implemented through Kaizen workshops, which were conducted concurrently with IDP workshops. The client, who was actively engaged in the IDP sessions, identified the necessity of involving users to ensure the project's success. This need was further validated when the final design presented by project professionals failed to meet the actual requirements articulated by users during the Kaizen workshops.

When stakeholders were questioned about the absence of end-user participation in the IDP workshops, responses varied. Some stakeholders attributed the exclusion to a decision made by the client, while others cited concerns regarding project confidentiality and the potential risks associated with involving users. Additionally, challenges such as communication difficulties and time constraints were frequently mentioned as factors contributing to the limited engagement of users in the IDP process. The findings from this case strongly indicate that user involvement, particularly through participatory design processes like those observed, is essential for accurately capturing and defining project values that align with the needs of both clients and end users.

In contrast, the second case exemplifies how the inclusion of users, particularly in the early stages of project development, can significantly enhance the alignment of project objectives with user needs. Workshops that actively involved users, illuminated the importance of addressing both functional and aspirational criteria within the project scope. The ability to

capture these user-defined values early in the process allowed the project team to adapt to the evolving needs of stakeholders more effectively. However, this case also revealed challenges in fully integrating these values into the final design due to constraints related to time and budget.

Overall, the findings from both case studies underscore that user participation—especially through structured and participatory design approaches—is crucial for defining and refining project values. This alignment not only enhances the likelihood of project success but also ensures that the final deliverables meet the expectations and requirements of all stakeholders involved.

### 5.1.6 Projects Processes

The Integrated Design Process encompasses a structured framework consisting of multiple predefined stages that can be tailored to accommodate the specificities of individual projects. Participants in Case 1 consistently expressed a high regard for the collaborative environment fostered by the IDP, highlighting its importance in facilitating effective communication and engagement among stakeholders. This early involvement of key stakeholders was deemed essential for aligning project goals with user needs and expectations. However, many participants cited the structure of the workshops as being lengthy and, at times, excessive. This feedback indicates a potential area for improvement in the workshop design, as the duration and intensity of sessions may hinder participant engagement and productivity.

Observations from the workshops, along with participant comments, suggest that the IDP process would benefit from greater flexibility and dynamism to achieve optimal results. Adapting the process to reflect the unique characteristics and challenges of each project is critical for enhancing its effectiveness. While many participants appreciated the practice of proposing various design options as a positive aspect of the workshops—allowing for tangible comparisons between solutions—some voiced concerns that a multitude of options could lead

to confusion and dilute focus. Striking the right balance between offering diverse choices and maintaining clarity in decision-making is crucial for facilitating effective collaboration.

In terms of process benefits, the participatory approach observed in both case studies not only contributed to better alignment with user needs but also introduced several significant advantages that enhanced the overall project outcomes. The iterative nature of the workshops allowed for the continuous identification and resolution of key issues, such as site constraints and user flow, which ultimately led to more resilient and adaptable project designs. Additionally, this collaborative approach fostered improved transparency among stakeholders, enhanced risk management, and facilitated a more responsive project design process.

The collaborative environment cultivated by these processes was instrumental in mitigating the silo mentality that often pervades construction projects, promoting a more integrated and holistic approach to project delivery. This integration of perspectives and expertise from various stakeholders enriched the design process and resulted in a more comprehensive understanding of project goals. However, the findings also underscore that these benefits are contingent upon the inherent flexibility of the process and the ability to adapt methodologies like IDP Kaizen workshops and LLD workshops to the specific challenges each project presents.

A recurring theme throughout the case studies was the tension between maintaining process rigor and fostering innovation and user input. This highlights the necessity for a more nuanced approach to participatory design that accommodates the diverse needs of stakeholders while ensuring the integrity of the design process. Future projects may benefit from implementing strategies that enhance participant engagement, streamline workshop structures, and promote iterative feedback mechanisms, thereby maximizing the collaborative potential and ensuring the successful alignment of project outcomes with stakeholder expectations.

### 5.1.7 Integration of IDP and Lean Methodology

As presented in CHAPTER 3, the first case study involved the parallel application of methodologies, with different participants assigned to each approach. Consequently, it can be stated that the integration of Lean methodology, specifically Kaizen, with the IDP was minimal. This lack of integration can be considered a contributing factor to both the increased confidence of users and professionals in the process and the delivery of a final design that was not adequately tailored to user needs, ultimately necessitating rework by the professionals involved.

In the high-school expansion case, the introduction of the Lean Led Design methodology occurred after the commencement of the IDP. This late inclusion was perceived by many participants as disruptive and unexpected. Several stakeholders expressed concerns that the LLD methodology seemed redundant, as it appeared to duplicate processes already addressed within the IDP. These observations suggest that when integrating a new methodology into an established process, it is crucial to effectively present and justify the method's inclusion to facilitate acceptance among participants.

Furthermore, the client representative expressed skepticism regarding the applicability of the LLD methodology to a school project, suggesting that it might be better suited for more complex projects, such as hospitals. However, in discussions with Lean Design specialists, who had successfully implemented this process in various contexts, it became evident that the complexities involved in school and hospital projects are comparable. This indicates a gap in understanding the level of complexity inherent in different project types, leading to an underestimation of the efforts required to ensure a project that truly meets user needs and delivers value.

In conclusion, while the integration of user participation through participatory design processes offers significant benefits, its success hinges on the effective management and adaptation of these processes to the unique characteristics of each project. The case studied, provided

valuable insights into how user involvement can be optimized to enhance project value and success. These findings lay the groundwork for further research on refining participatory approaches in construction projects to better meet the complex demands of modern construction.

### 5.1.8 General case analysis

The case studies highlight the importance of user participation in LLD and IDP workshops to align project outcomes with user values. While the workshops facilitated collaboration and valuable discussions, challenges such as communication barriers, reliance on facilitators, and limited decision-making authority hindered their full potential. Additionally, the lack of integration between Lean and IDP methodologies often resulted in designs that did not fully reflect user needs.

Though stakeholder acceptance of these processes improved over time, initial resistance, especially when introducing new methodologies mid-process, highlighted the need for better preparation and communication. Ultimately, the study emphasizes that successful project outcomes depend on flexible, user-centered approaches that ensure continuous engagement and clear decision-making throughout the project lifecycle.

The analysis of the cases also revealed a lack of clarity within the construction industry professionals regarding the client's ability to determine the needs of the users of their projects. This highlights the need for better preparation of industry professionals to guide both the collection of user requirements and assist in clarifying the client's requirements.

Table 5.2 Summary of case studies analysis

| | **Case 1** | **Case 2** |
|---|---|---|
| **Focus on Value** | - IPD Workshops focused on user-defined values, but misalignment between final design and user expectations was noted.<br>- Kaizen workshops had a greater emphasis on spatial needs for students and faculty. | - Value-driven from the project's inception, aiming to modernize schools.<br>- Workshops (IDP and LLD) focused on capturing the diverse needs of various users, including teachers and students. |
| **Collaboration** | - Workshops promoted collaboration but were heavily reliant on facilitator input.<br>- Limited engagement from some stakeholders due to communication challenges. | - Collaborative environments enabled effective interaction among stakeholders.<br>- Stakeholders were able to fully communicate their needs due to the trust environment created. |
| **Decision Making** | - Divergence in perspectives on decision-making authority, with some feeling excluded.<br>- Decision criteria inconsistencies between workshops led to incertitude in the decision process. | - Decision-making was more structured due to the presence of key decision-makers in the Big Room and the use of a structured documentation of the decisions taken. |
| **User Participation** | - Limited user participation in the IDP workshops, which led to misaligned outcomes.<br>- Students and professors were involved in Kaizen workshops, but their contributions were not fully captured in the IDP workshops. | - Early and active user involvement in IDP helped refine project requirements.<br>- LLD workshops illuminated both functional and aspirational needs, allowing for better alignment with goals. |

Table 5.2 Summary of case studies analysis (continues)

| | **Case 1** | **Case 2** |
|---|---|---|
| **Challenges** | - Communication barriers, reliance on facilitators, and technology issues hindered workshop effectiveness.<br>- Participants struggled with transitioning away from siloed work. | - Late integration of Lean methodology caused skepticism but eventually gained acceptance.<br>- Leadership changes caused initial delays but were mitigated with the process structure.<br>- Session preparation time posed challenges to professionals, that expected workshops to be better aligned with their needs. |
| **Process Structure** | - IDP workshops were seen as valuable but sometimes too lengthy.<br>- The process was rigid, limiting adaptability to user input. | - The process was more iterative, allowing for continuous refinement based on feedback.<br>- Greater flexibility in addressing user needs and adapting project designs. |
| **Integration of Lean Methodology** | - Minimal integration of Lean methodology with IDP.<br>- Misalignment between user expectations and design, outcomes necessitated rework. | - Lean methodology was introduced after IDP began, leading to initial skepticism.<br>- Over time, it enhanced decision-making and allowed for value-driven design refinements. |

The analysis of case studies and interview responses highlights the critical importance of user involvement in identifying needs and defining value. However, the Integrated Design Process is not a methodology specifically focused on value generation. As such, the exclusive exploration of these cases does not guarantee a precise identification of the challenges associated with including users in value definition, although it does provide initial indications

of the difficulties that may arise when integrating these stakeholders directly into construction projects.

To address this gap in knowledge, interviews were conducted with experts in the implementation of TVD in construction projects. These interviews aimed to understand how such projects involve users and identify the challenges encountered in this process. The findings from the interviews, presented in the following section, were intended to complement the previously obtained knowledge on value-focused methodologies, contributing to the development of a user inclusion structure for such construction projects.

## 5.2 TVD Interviews

The interviews conducted with industry professionals reveal critical insights into the implementation of Target Value Delivery in construction projects. The findings are organized by key themes that emerged from the discussions.

### 5.2.1 TVD Implementation

The implementation of TVD in construction projects is fundamentally rooted in collaborative practices that emphasize early and continuous engagement among all stakeholders. Recognizing the importance of this engagement, general contractor professional (ME3) raised the issue of selecting the appropriate professionals for the project. He argued that the first stakeholder chosen should be someone capable of directly addressing the client's core objectives. Subsequent professionals should then be selected based on their ability to collaborate effectively with this primary stakeholder and align with the client's goals.

Furthermore, according to the consultant specialized in collaborative practices (ME1), integrated design processes that involve architects, engineers, clients, and end-users are crucial for effectively aligning project scope, budget, and timelines. ME1 highlighted that fostering a

shared understanding among all parties can significantly mitigate conflicts later in the project lifecycle, ultimately leading to improved project outcomes.

A critical aspect highlighted by the construction industry professional (ME2) is the application of TVD in large-scale projects. In such projects, particularly in the industrial sector, TVD is often initiated even when designs are incomplete. This approach allows contractors to contribute to estimating costs and managing resources early in the process. ME2 noted, "In Alberta, we often start with incomplete designs, but the contractor's early involvement allows for real-time adjustments as the design evolves," underscoring the iterative nature of the TVD process.

The architect (ME4) provided a distinct perspective by differentiating between the concepts of "designing to a detailed estimate" and "estimating a detailed design." This approach emphasizes the importance of creating a robust, detailed estimate before design work begins, enhancing the project's ability to adhere to budgetary constraints. ME4 stated, "The goal is to maximize the value delivered within target numbers by creating tighter feedback loops between design actions and cost implications," reflecting the focus on value optimization throughout the design phase.

ME6 provided a detailed exploration of the philosophy underpinning TVD, highlighting that its effectiveness hinges on a fundamental shift in perspective. Unlike traditional construction processes, which typically treat buildings as static entities, TVD embraces flexibility by allowing design adjustments based on fixed estimates. As ME6 succinctly put it, "In traditional construction, the design is rigid, but in TVD, the estimate is fixed, allowing the design to adapt to budget constraints." This statement encapsulates the core philosophy of TVD, illustrating its innovative approach to project development.

In addition to this core principle, ME6 underscored the critical importance of establishing value for construction projects. He stated, "The definition of the project starts with the values; before you can do any drawing, you have to understand what the values are." This assertion

emphasizes that a clear understanding of values is essential for guiding design decisions, ensuring that final outcomes align with stakeholder objectives. By prioritizing values, TVD fosters a more integrated and responsive design process, ultimately leading to better project results.

### 5.2.2 Challenges in TVD Implementation

Despite the recognized benefits of TVD, several challenges impede its effective implementation across various projects. One prominent issue identified by ME1 is cultural resistance within organizations, where established norms and practices can hinder the adoption of collaborative methodologies. "There's often a disconnect between what the client needs and how the design team interprets those needs, compounded by the reluctance to change established processes," ME1 remarked, highlighting the difficulties faced in shifting organizational mindsets.

ME4 highlighted the enhancement of decision-making capabilities as one of the significant benefits of Target Value Delivery. However, ME2 pointed out that the complexities of decision-making in large-scale projects pose a substantial challenge. With multiple stakeholders involved, delays in decision-making can adversely affect project schedules and budgets. ME2 elaborated on this issue, stating, "In large projects, too many decision-makers can complicate the flow of information, leading to inefficiencies that impact timelines."

Conversely, the absence of a client representative with the authority to make decisions can also hinder the effective implementation of TVD. As confirmed by ME5, having a designated decision-maker is crucial for ensuring the success of the process. Together, these insights emphasize the need for streamlined communication and clear authority in decision-making to maximize the benefits of TVD.

The general contractor professional (ME3) emphasized the importance of accurate cost estimates at the project's outset. Many projects struggle with setting realistic target costs due

to reliance on outdated data, which can create discrepancies between estimated and actual costs. ME3 explained that "many construction projects often rush into design without establishing a solid estimate, leading to a cycle of design, pricing, and redesign," reflecting a common pitfall in the industry.

Additionally, ME6 articulated the necessity of a cultural shift to effectively embrace TVD. He noted, "All types of projects, whether hospitals or universities, encounter similar difficulties due to the significant change management required." This statement underscores that successful implementation of TVD hinges on cultivating a culture that values innovation and flexibility.

Furthermore, ME6 emphasized that the commitment of every team member is crucial for the project's success, stating, "If any team member does not believe in the process, the project is at significant risk of failing to meet its objectives." This highlights the importance of a unified belief in the TVD methodology as a key factor in achieving project goals.

### 5.2.3 Collaboration and User Involvement

Collaboration emerged as a vital theme across the interviews, underscoring the necessity of effective communication among all project stakeholders. ME1 highlighted that collaborative design processes are essential for aligning project scope, budget, and timelines. The importance of co-location, where team members work in the same physical space, was emphasized as a facilitator of better communication and decision-making. "Co-location fosters better interactions and builds trust among team members," ME1 stated, indicating that physical proximity enhances collaborative efforts.

The construction professional (ME2) reinforced this sentiment by noting that effective collaboration leads to improved project outcomes. "When all stakeholders are in the same space, we can make decisions faster and address issues more efficiently," ME2 explained, stressing the benefits of a unified project team. Furthermore, ME2 discussed the use of

Building Information Modeling (BIM) and the Last Planner System as crucial tools for ensuring effective collaboration in TVD projects.

User involvement was deemed essential for ensuring that client needs are met. ME1 emphasized the importance of regular workshops and facilitation to align project values with client expectations. "Involving clients and end-users in the design process ensures their needs are accurately captured and addressed," ME1 explained. This perspective was echoed by ME3, who pointed out that early engagement of end-users is crucial for accurately capturing their needs and ensuring the project delivers the intended value.

ME5 highlighted the need for clear communication regarding target values early in the project. "Understanding owner target values is critical for achieving successful project outcomes, especially when navigating the complexities of collaborative contracts," ME5 noted. This point underscores the necessity of aligning stakeholder expectations with project goals from the outset.

### 5.2.4 Change Management in TVD Implementation

Change management plays a pivotal role in the successful implementation of TVD, as it involves transitioning teams from traditional project delivery methods to more collaborative and iterative approaches. ME6 emphasized that adopting TVD requires a fundamental shift in mindset among all team members: “What we do in integrated project delivery and target value delivery is we are change managers. You know what I mean by that—change managers—and the catalyst or the tools are the agents of change, but it’s the mindset that must be changed.” ME6 added, "The biggest challenge in implementing TVD is ensuring that teams are open to change and willing to adapt their working styles."

This cultural shift is necessary to facilitate collaboration and maintain a focus on project goals throughout the lifecycle. ME4 echoed this sentiment, noting that "successful TVD implementation hinges on creating a culture that embraces innovation and is willing to rethink

established practices." The change management process must also address resistance from stakeholders who may be accustomed to traditional construction methodologies.

The director of Project Development (ME5) pointed out that engaging all stakeholders in the change process is critical. "When implementing TVD, it’s important to foster a collaborative environment where everyone feels invested in the project’s success," ME5 explained. This collaborative culture can be cultivated through effective communication, training, and leadership support.

ME1 added that training programs are essential for equipping team members with the skills and knowledge required to adapt to new processes. "Training and ongoing education help teams understand the principles of TVD and how to effectively collaborate," ME1 noted. By investing in change management and training, organizations can minimize resistance and enhance the overall effectiveness of TVD implementation.

Additionally, ME6 stressed the importance of continuous feedback loops in the change management process. "Establishing mechanisms for ongoing feedback allows teams to address challenges and make necessary adjustments throughout the project," ME6 explained. This iterative approach not only supports successful TVD implementation but also reinforces the value of collaboration among stakeholders.

### 5.2.5 Best Practices and Success Factors

The interviews revealed several best practices for successful TVD implementation, emphasizing the need for early and continuous engagement with all stakeholders. ME1 indicated that successful TVD projects often involve proactive communication and collaboration throughout the project lifecycle. "Engagement with stakeholders should be early and frequent to ensure alignment on project goals," ME1 stated.

ME2 stressed the importance of transparency and iterative processes in achieving successful outcomes. "Iterative estimating allows for real-time adjustments based on project developments, which is crucial for maintaining alignment with target costs," ME2 remarked. This highlights the necessity for dynamic feedback mechanisms that facilitate ongoing assessment and adjustment of project goals.

The general contractor professional (ME3) advocated for continuous focus on value optimization during both design and production phases. "Focusing on value continuously helps teams identify cost-saving opportunities without compromising quality," ME3 explained, pointing to the need for ongoing evaluation of project performance against established value metrics.

Training and change management emerged as critical elements in ensuring the effectiveness of TVD principles. ME4 emphasized the need for ongoing cultural training to maintain team alignment, stating, "Cultural training is essential to ensure that everyone is on the same page regarding TVD principles." Similarly, ME6 noted that continuous education is vital to avoid costly mistakes during the project lifecycle, indicating that teams must be well-versed in the principles of collaborative delivery.

### 5.2.6 Real-Life Examples and Lessons Learned

The discussions included reflections on specific projects that showcased the successful application of TVD principles. ME1 provided examples of both successful and failed projects, underscoring the importance of adherence to key principles such as realistic target cost setting and effective stakeholder engagement. "Successful projects align closely with target values, while failures often stem from poor engagement and misalignment with client expectations," ME1 remarked.

ME3 shared insights from projects where misalignment between cost estimates and project goals led to challenges, highlighting the need for realistic target costs. "In some cases, projects

faced difficulties because the target cost was set unrealistically low, leading to design issues," ME3 explained. This underscores the importance of setting achievable and well-informed target costs from the beginning.

ME6 shared a compelling case from a hospital project where innovative design changes facilitated by TVD principles led to significant cost savings. The project team combined the functions of overhead lighting and patient lift systems into one design, which not only reduced costs but also added functionality. "By promoting creativity and innovation, TVD can result in substantial savings and improved project outcomes," ME6 stated, highlighting the benefits of a collaborative approach to problem-solving.

Lessons learned from the interviews consistently emphasized the necessity of cultural change to effectively embrace TVD. ME5 cautioned against working in silos, as this approach can lead to misalignment with target values and project goals. He stated, "Collaboration must be prioritized to ensure that all team members are working towards the same objectives."

In a similar vein, ME6 highlighted that during Big Room meetings in their TVD projects, team members would regularly revisit the established values and evaluate whether the proposed solutions aligned with those values. This practice underscores the importance of maintaining a collaborative environment that continually reinforces shared objectives, ultimately enhancing the effectiveness of TVD implementation.

In summary, the insights from these interviews reinforce that successful implementation of TVD requires a collaborative mindset, accurate cost estimation, and continuous engagement with all stakeholders. The experiences shared by industry professionals illuminate both the challenges and best practices that can guide future projects towards achieving enhanced value delivery.

### 5.2.7 General Interviews analysis

The interviews collectively highlight the significance of Target Value Delivery in the construction industry, emphasizing the necessity of collaboration among all stakeholders, including architects, engineers, contractors, and end-users. For the professionals interviewed successful TVD implementation depends on an integrated process, with co-location being crucial for effective teamwork, preferably by presential meetings, as hybrid meetings can sometimes fail to include all the participants in the discussion.

Cultural resistance and the challenge of accurate early cost estimation are major barriers to TVD, requiring a shift from traditional methods and a commitment to continuous feedback and iterative design adjustments. From the experience of one the interviewees modular construction is noted as particularly well-suited to TVD, enabling better control over costs and design within specific budgets.

Success in TVD is tied to early and consistent stakeholder engagement, including the involvement of end-users, to ensure that the project meets their needs and delivers value. Agile methodologies and continuous training are recommended to support the transition to TVD. The interviews provide real-life examples that illustrate the benefits of adhering to TVD principles, as well as the challenges that arise when trying to implement it.

The role of user involvement is considered critical for all the professionals, although the definition of the user for each professional presents some controversy, as some of the professionals interviewed acknowledge gather information of needs and requirements from operators and maintenance users and not search direct information with the final users, trusting the capacity of the owner to define these last one.

Ultimately, by the vision of the interviewees TVD leads to better project outcomes by aligning design with the owner’s values and goals. Proper implementation of TVD requires from

professionals a cultural change and management of iterative processes, but it can result in projects that stay within budget while delivering significant value to the end-users.

These interviews also provided valuable insights into the reasons for discrepancies in the implementation of the processes involved in this approach. Although the interviewed experts operate within the same country, significant differences were observed in their interpretations of TVD and the core principles underlying this approach. This demonstrates a clear need for standardization and greater dissemination of the processes related to value setting and delivery.

Table 5.3 Summary of interview collected information

| | **Key Insights** |
|---|---|
| **TVD Implementation** | - Early and continuous engagement of all stakeholders is critical.<br>- Collaboration among professionals, contractors, and users helps align project scope, budget, and timelines.<br>- Flexibility in design allows for real-time adjustments and value optimization. |
| **Challenges in TVD Implementation** | - Cultural resistance and reluctance to change hinder TVD adoption.<br>- Decision-making delays due to multiple stakeholders can impact project efficiency.<br>- A unified belief in the TVD process across the team is essential for project success. |
| **Collaboration and User Involvement** | - Co-location of team members enhances communication and trust.<br>- Involvement of clients and end-users ensures that project outcomes meet their needs.<br>- Frequent workshops are vital for aligning expectations and values throughout the project lifecycle. |

Table 5.3 Summary of interview collected information (continues)

| | **Key Insights** |
|---|---|
| **Change Management** | - A shift in mindset is required to transition from traditional methods to TVD.<br>- Change management includes training and leadership support to ensure successful adoption.<br>- Continuous feedback loops facilitate iterative improvements throughout the project. |
| **Best Practices and Success** | - Early, transparent communication and iterative processes are key to success.<br>- Regular focus on value optimization helps identify cost-saving opportunities without compromising quality.<br>- Continuous education and training support effective TVD implementation. |
| **Real-Life Examples and Lessons** | - Successful projects align closely with target values, while failures often result from poor stakeholder engagement.<br>- Innovative design changes facilitated by TVD can lead to significant cost savings and improved outcomes.<br>- Collaboration must be prioritized to avoid misalignment. |
| **General Insights from Interviews** | - Co-location and continuous feedback are vital for effective teamwork and decision-making.<br>- Modular construction is particularly well-suited to TVD, enabling better control over costs and schedule.<br>- Agile methodologies and user involvement improve project outcomes. |

# CHAPTER 6

# A PROPOSITION OF A COMPREHENSIVE TARGET VALUE SETTING PROCESS

The conducted interviews corroborate what is presented in the literature, emphasizing that project definition begins with a clear understanding of the concept of value. Therefore, the project definition phase must start with a thorough analysis of what constitutes value for the project.

Despite advances in value-focused process development, much of the existing information and implemented processes fail to address the initial stages adequately. For a thorough value definition, it is necessary to engage in a more comprehensive approach.

To ensure the delivery of value to end users in highly complex construction projects, it is crucial to first identify who the project's users are and their needs, as well as, understand the real needs of the client, and recognize what constitutes value for the professionals involved.

The analysis of the observed case studies and interviews conducted supports the proposed solution illustrated in Figure 6.1, that emphasizes the early stages of project definition. This includes a necessary validation process throughout the project's development to ensure alignment with the defined value.

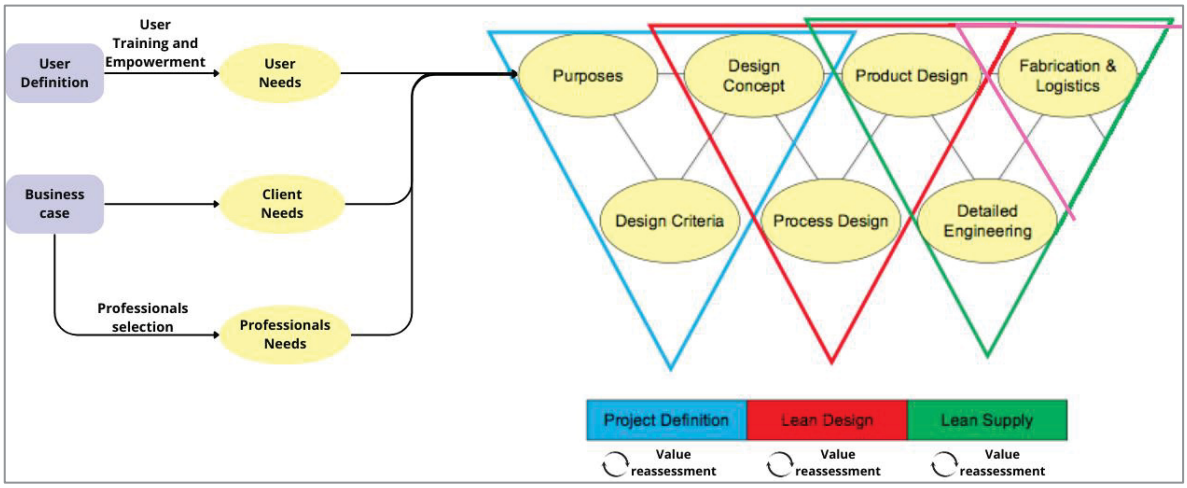


Figure 6.1 Proposed steps addition for the project Propurpose definition
Adapted from Ballard (2008, p. 5)

The figure presents key stages to be considered in order to fully define the project's purpose and key value. The first step in initiating the process is the client's definition of the Business Case. This phase has been extensively explored in the literature, and clients generally have a well-defined Business Case. Therefore, this discussion will not focus on that particular aspect.

As highlighted in the literature and reinforced by both case study analyses and interviews, the selection of professionals involved in the project is critical for its successful progression. There is already a strong emphasis on selecting professionals who embody a spirit of collaboration and openness. However, in order to facilitate better integration of these professionals, a more structured approach to selection is proposed in the following section (Section 6.1). The client's Business Case is fundamental to both the selection of professionals and the definition of the client’s needs for the project.

Defining the client's needs, alongside the Business Case definition, has received significant attention in complex projects and is depicted as a clear and well-implemented phase in such settings. Moreover, according to Alastair & Worthington (2001) and Smith, Love, & Wyatt (2001), the design professionals selected can assist the client in refining their vision and identifying potential weaknesses and opportunities for improvement in their stated needs.

One of the less-explored areas in complex projects pertains to the end-users of these developments. The reviewed literature strongly emphasizes the importance of considering the user during the process but offers limited guidance on how this consideration should be implemented. Based on case study analysis and interviews with professionals, a framework for incorporating user input into the process has been developed. This framework comprises several stages: first, identifying who the users are; second, empowering and training users to clearly express their needs and expectations; and finally, capturing those needs in a way that provides clear, non-conflicting information that contributes to the definition of the project's purpose and key value. Each of these stages is further detailed in Sections 6.2, 6.3, and 6.4.

Additionally, an underexplored aspect in the literature is the definition of the needs of the professionals involved in the project. The literature review revealed that the individual values of stakeholders often contribute to differing perceptions of the benefits of proposed solutions and processes. Therefore, in order to maximize value for all parties, identifying these values is crucial. Section 6.5 provides a summary of some factors that stakeholders consider as criteria for added value.

A notable challenge identified is that the process of considering added value is not yet common in the construction domain. The analyzed cases clearly show that many participants initially struggled to adapt to this process. As such, change management is necessary to ensure that value generation for users is successfully implemented. This strategy is explored on section 6.6.

Finally, simply defining the expected value does not guarantee it will be achieved. It is necessary to implement a good decision-making process (see section 6.7) and make sure the values are considered. As seen in Case 1, many of the initially defined values were not consistently considered throughout the process. A solution to this issue is to revisit these values (see section 6.8) regularly from the project definition phase through to its delivery. Each of the above-mentioned topics is explored in more detail in the following sections.

## 6.1 Selection of professionals for the project

Based on the information gathered from both the observations of the workshops and interviews with professionals experienced in TVD, it became clear that an effective selection of stakeholders is crucial for the success of the process. Among the key requirements mentioned are the participants' ability to deliver the required solutions, work collaboratively in a transparent environment, and engage fully in the process. Therefore, these individuals must not only possess the necessary skills but also have the availability to actively participate in Big Room discussions.

Regarding the selection process, it should primarily be guided by the value that the client seeks to achieve with the project. A stakeholder selection process can be structured, as illustrated in Figure 6.2.

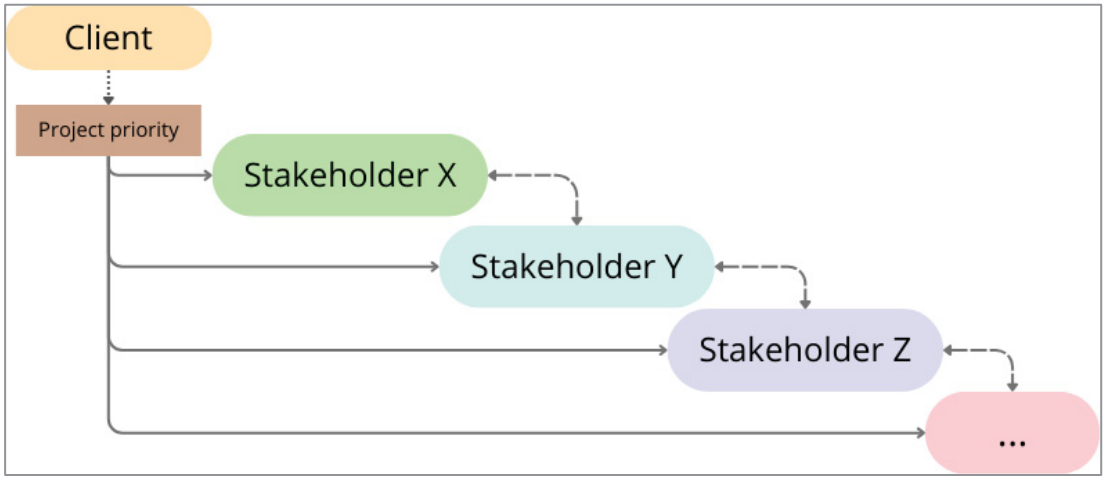


Figure 6.2 Stakeholder selection process considering project priority and collaboration capacity

The client must first define their priorities for the project. For example, if they aim for an architecturally iconic design, the selected stakeholder (Stakeholder X) should possess the skills and expertise to create such a design. Alternatively, if the focus is on energy efficiency, the chosen professional (Stakeholder X) must have experience in delivering energy-efficient

projects. Based on this priority, the client should select professionals capable of achieving the desired vision and goals.

After choosing this professional, the client should also evaluate their ability to collaborate effectively with the next stakeholder in line. This careful selection process reduces the likelihood of misalignment or collaboration issues among stakeholders.

It is essential to emphasize that, to ensure alignment, the client must be transparent with stakeholders about the project's objectives from the outset. A crucial element in TVD is that all participants must be fully committed to the project. The client must also be willing to replace individuals who do not support the process. Experts interviewed highlighted that the presence of someone who lacks trust in the process can undermine the entire project, as their disengagement can negatively influence the rest of the team.

## 6.2 User definition

As discussed in the preceding chapters, the end user is often not directly considered in project planning, with the client typically acting as a proxy for the user. While this assumption may be valid for certain projects, it proves less realistic for complex projects involving multiple user profiles. In such cases, the client is rarely capable of fully representing the needs of all user groups, particularly when their requirements may diverge.

To streamline the capture of user requirements, the first necessary step is identifying the various user profiles relevant to the project. This requires an initial analysis by the client, who, in developing their business plan, identifies the intended users that the project will serve. For example, in the case of an educational institution, the relevant user profiles include students, teachers, assistants, administrators, staff, students' parents, and possibly the surrounding community, depending on the institution's openness to external engagement.

It is clear, however, that these user groups cannot all be given equal consideration throughout the entire project. Thus, it is also necessary to identify which profiles should be prioritized, and this prioritization may vary depending on the specific space being developed.

The analysis of case studies and interviews conducted leads to the conclusion that, for optimal utilization of educational spaces, priority should be given to students and teachers. However, certain areas, such as service zones, should be designed to accommodate the needs of maintenance and operational staff.

### 6.3 User Training and Empowerment

Before gathering users' needs and requirements, it is essential to ensure that they are sufficiently empowered to actively participate in the project. The Lean Design approach, as observed in the workshops of Case 2, demonstrated that empowering users enhances their understanding of both the project and its processes.

One common concern highlighted in the literature regarding user inclusion is the challenge of communication, often attributed to users limited technical knowledge of construction-related aspects. However, professionals interviewed who work with TVD emphasize that involving users in the requirements definition process does not necessitate advanced technical expertise. What is most critical, according to these professionals, is fostering an open environment where users' concerns and input can be heard and valued.

Despite this, the Kaizen workshop for requirements definition in Case 1 revealed that the student participants were not adequately prepared to define clear and actionable requirements for the project. Therefore, as part of the preparation process, it is recommended to provide participants with less experience a guide that outlines the type of information expected from them. This will help ensure that their input is relevant and useful to the project’s goals.

## 6.4 Gathering User Needs

Gathering information from users is crucial for defining project requirements, and this can be achieved through various methods. In Case 1, information was collected during a Kaizen workshop, where representatives from each user group presented their perspectives. Following these presentations, they actively participated in the workshop to collaboratively define the project's core values.

In Case 2, the initial requirements were established through a document prepared by the ministry, developed with input from students and teachers across multiple schools in the region. Refinement of these requirements was accomplished through workshops, where school representatives provided feedback on how to improve the ministry's initial proposals.

Both methods of gathering requirements are valid approaches. When asked about their preferred methods, Target Value Delivery specialists mentioned a variety of techniques, including interviews, surveys, simulations, and mock-ups. The selection of these methods depends on the user profiles and the number of users to be considered.

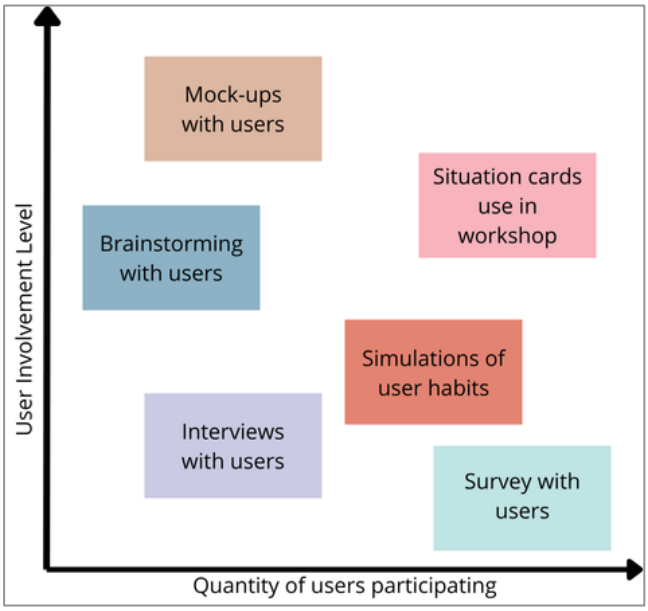


Figure 6.3 Tools for user inclusion in the project

For key user groups, it is recommended to involve a representative who has a deep understanding of the group's daily routines in the requirements and values definition workshops. This direct interaction between the user representatives and the project's design professionals helps mitigate potential misinterpretations that can occur when requirements are communicated indirectly, such as through a facilitator or client.

In situations where confidentiality concerns prevent direct user participation, one solution proposed by a TVD specialist is for the design professionals to experience the user environments firsthand. This allows the design team to gain a deeper understanding of the users' needs and propose more informed solutions for the project.

Once the users' values and requirements are defined, the overall project value can be established, integrating both the specific needs of the client and the objectives of the professionals involved in the design.

## 6.5 Other stakeholders value definition

This stage is rarely mentioned in studies and even less during actual project execution. Professionals selected to participate in projects often have individual goals, and understanding what each stakeholder considers valuable can not only ensure alignment between their values and the project objectives but also allow for the adaptation of processes to ensure that these stakeholders experience the added value of the collaborative project. Using these criteria as success indicators for the project can foster greater engagement and even encourage other parties to strive toward achieving these goals.

Table 6.1Process searched values from stakeholders for the design and construction project phases
Taken from Tillmann (2012)

| **Design** | **Construction** |
|---|---|
| Collaboration | Collaboration |
| Trust | Efficiency |
| Efficiency | Easiness to build |
| Ability to deliver on time and budget | Ability to deliver on time and budget |

## 6.6 Change management

The implementation of TVD in projects still encounters significant challenges, with change management being one of the most prominent. Many companies begin the process of adopting TVD but often abandon it early because they do not see the expected results or, worse, experience negative outcomes from the process.

As with any drastic change, positive results take time to materialize and require substantial commitment from participants to reach the point where the change is fully integrated. Kübler-Ross presented a model (Figure 6.4) illustrating how individuals typically progress through the stages of change. This model highlights that, when a new approach is introduced, employees often experience frustration and demotivation, necessitating increased support from their managers to navigate through the transition.

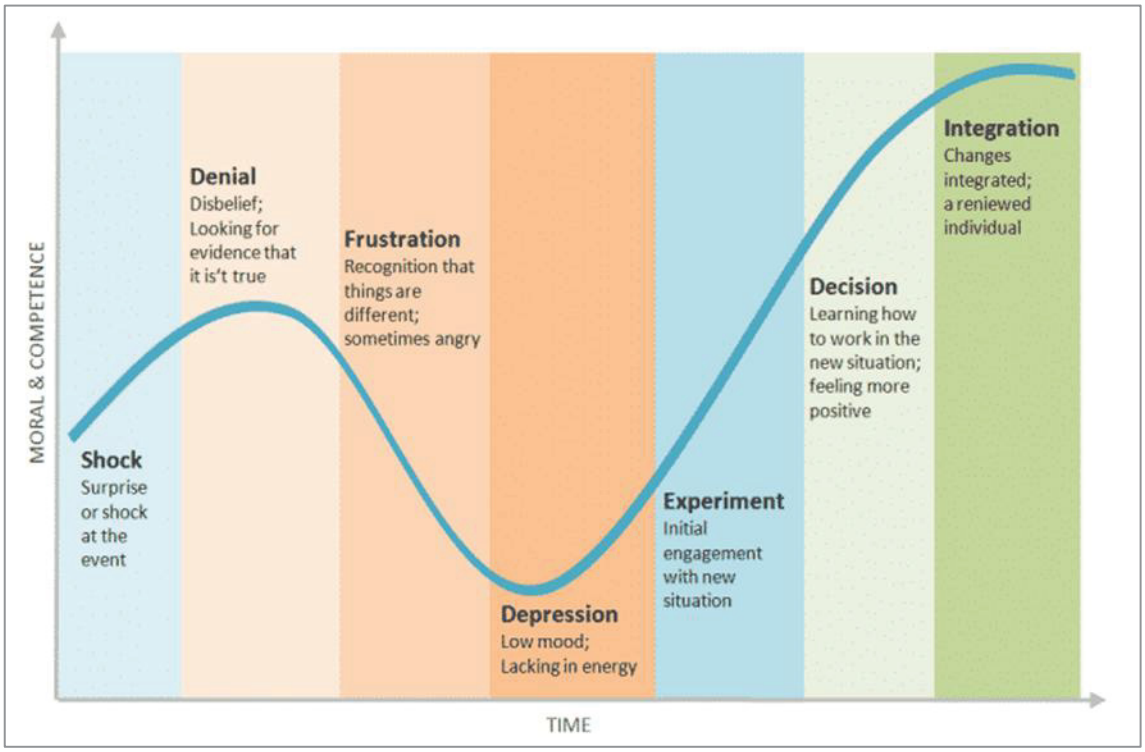


Figure 6.4 Kübler Ross' Change Curve Model
Taken from Belyh (2022)

Implementing TVD, especially with its focus on value rather than just cost reduction—commonly prioritized in construction projects—requires project managers to have the necessary knowledge and skills to guide and reinforce this shift. It is crucial to ensure that participants do not fall back into old habits, such as prioritizing cost and risk avoidance.

To achieve this, the professionals involved must be prepared for the challenges that come with this paradigm shift in construction. Moreover, they should understand that success will not be immediate; instead, it demands a mindset of continuous improvement and collaboration from all participants.

## 6.7 Decision Making

One of the most significant benefits of the TVD process, as highlighted in the interview data, is the enhancement of decision-making capabilities. However, to fully realize this benefit, it

is crucial that decisions be made in the Big Room with the participation of all stakeholders. For this process to be effective, decision-makers with the authority to make key choices must be present in the Big Room, ensuring timely decisions and preventing any delays that could impact the project timeline.

Another essential criterion for ensuring project progress is the establishment of a structured and clear decision-making process. All participants must have the same understanding and clarity about when decisions need to be made and who is responsible for making them.

The use of a responsibility matrix, along with a well-defined timeline for decision-making moments, help participants track decisions as they are made. This not only ensures that everyone can contribute to discussions leading to decisions but also makes them aware of the specific moments when critical decisions for the project are finalized. This clarity ultimately enhances the overall value delivery process.

## 6.8 Value reassessment

Defining project values at the outset of the project definition phase is insufficient to ensure that these values will be maintained throughout the project lifecycle. Whelton & Ballard (2002) emphasize the importance of revisiting values iteratively during the project definition process to ensure that the design remains aligned with evolving requirements. This approach is particularly crucial for long-term projects, where the definition phase may span several months, increasing the risk of evolving requirements. In such cases, there is a heightened risk that the initial values may become outdated or misaligned with new challenges.

Additionally, a point that is often overlooked is that as challenges arise during the project, there is a risk that these values may either be unintentionally disregarded or consciously deprioritized. This makes it essential to continuously assess whether the project team is delivering on the defined values to achieve the desired outcomes. Without this continuous assessment, there is a risk that the project will stray from its original goals.

The proposed approach advocates that during each workshop participants select specific project values and assess how the proposed solutions align with them. By doing so, the team can quickly identify if a solution fails to address key values and make necessary adjustments to their approach. This ensures that the values remain central to decision-making throughout the project lifecycle. Had this method been applied in Case 1, it could have ensured a stronger alignment between the final proposed solution and the user requirements established during the Kaizen workshop.

# CONCLUSION

This research has provided critical insights into the value of ensuring user participation in construction projects and demonstrated the effectiveness of Target Value Delivery as a tool for optimizing both cost management and stakeholder satisfaction. Through the exploration of two distinct case studies—the university campus expansion and the high school expansion projects—this study delves deeply into the practical implications of participatory methodologies, including the Integrated Design Process and Lean-Led Design, in complex construction environments.

The analysis underscores the importance of engaging users early and consistently throughout the project lifecycle, particularly during the project definition phase. User participation ensures that the final construction outcome not only meets technical and budgetary requirements but also aligns with the values, expectations, and needs of the end users. In both case studies, structured workshops involving multiple stakeholders helped to identify project values and functional requirements, which ultimately shaped the design direction.

Participatory methodologies like IDP and TVD fostered greater collaboration among stakeholders, while workshops, such as Kaizen and LLD, created a platform for users, architects, engineers, and project managers to work together and develop a shared vision. For instance, in the university campus expansion, the Kaizen workshops allowed users (professors and university staff) to express their vision for spaces that promote creativity, collaboration, and integration with the community. Similarly, in the high school project, involving users—teachers, students, and administrative staff—led to a design that better accommodated their daily routines and functional needs.

This research contributes to the growing body of knowledge on value-driven practices in construction projects by offering a nuanced exploration of user participation and its impact on value generation. By bridging theoretical frameworks with practical insights from real-world applications, this study provides both academic and industry practitioners with actionable

strategies for improving user engagement and value delivery. It emphasizes the importance of refining participatory methodologies to better align with user needs and improve collaboration and the decision-making process.

However, challenges remain in the effective application of these methodologies. The inherent complexity of construction projects, combined with the often fragmented nature of the industry, makes it difficult to maintain continuous stakeholder involvement. The case studies highlighted issues such as the rigidity of facilitation in some workshops, which occasionally stifled creative problem-solving, and the disconnect between decision-making processes and workshop outcomes. Moreover, there was a recurring tendency to focus on client-driven goals rather than fully integrating the perspectives of end users.

As a strategy to ensure a user-centered value definition, this thesis proposes the consideration of user and stakeholder needs, suggesting tools and steps that can assist in defining these values. Since the recommendations presented were developed based on observations of real cases and the experience of professionals experienced in implementing TVD, this thesis contributes to the growing body of knowledge on value-driven construction practices. It provides an actionable strategy for value generation and demonstrates the tangible benefits of participatory design methodologies in complex construction projects. It emphasizes that successful project outcomes depend not only on meeting budget and schedule constraints but also on ensuring that the final product delivers genuine value to its users. For the construction industry to evolve, there must be a shift toward more user-centric approaches that prioritize collaboration, transparency, and early stakeholder engagement.

The findings also highlight the need to refine existing methodologies to better integrate end-user perspectives. While tools such as IDP, TVD, and Lean-led workshops provide a robust foundation for collaborative decision-making, there remains a need for further development of strategies to ensure continuous user involvement throughout the project lifecycle. Specifically, future research should focus on creating more flexible frameworks for decision-making and

exploring how digital tools can be leveraged to enhance stakeholder engagement, especially in virtual and hybrid settings.

In conclusion, this thesis demonstrates that participatory methodologies, when combined with TVD and Lean approaches, offer significant benefits in terms of collaboration, cost management, and value delivery in construction projects. However, fully realizing these benefits requires addressing the challenges of stakeholder coordination, decision-making structures, and the integration of user perspectives. By adopting a more flexible and iterative approach to both decision-making and user involvement, construction projects can achieve more sustainable, functional, and user-centered outcomes.

To further enhance the implementation of participatory methodologies and value-driven practices in construction, several key areas require focused attention.

First, there is a pressing need for clearer strategies that ensure user input is incorporated throughout the entire project lifecycle, not just in the early stages. Continuous engagement from project inception to completion is essential to ensure that the final product aligns with the evolving needs and values of the end users. This approach fosters inclusivity and guarantees that decisions made during the design and construction phases genuinely reflect the diverse perspectives of all stakeholders.

Another important consideration is the need for greater flexibility in workshop facilitation. Facilitators must balance structure with creativity, allowing open-ended exploration of ideas while maintaining focus on project objectives. A more flexible facilitation approach encourages deeper problem-solving and innovation, creating an environment where stakeholders can freely explore novel solutions without deviating from the project's goals.

Additionally, the enhanced use of technology is crucial. Digital tools should be consistently integrated across all project phases to ensure meaningful stakeholder engagement, particularly in hybrid or virtual environments. Technology can bridge the gap between in-person and

remote participants, ensuring that all voices are equally heard. By leveraging platforms that enable real-time collaboration, such as 3D modeling and visualization tools, project teams can improve cross-disciplinary understanding and make more informed decisions.

Finally, strengthening decision-making frameworks is vital. Clear roles and responsibility matrices must be established to ensure that all stakeholder inputs are considered in final project outcomes. A well-defined decision-making process reduces miscommunication, streamlines project coordination, and ensures that each stakeholder's contributions are reflected in the final design and construction deliverables.

Further research is recommended addressing these areas—user engagement in multiple types of high complexity projects, workshop flexibility to adapt to professionals and project needs, combination of analog and technological tools for stakeholders' integration, and structuring of the decision-making during collaborative processes— so the construction industry can continue to refine its processes, ultimately delivering projects that are not only cost-efficient but also highly responsive to the needs of all stakeholders involved.

Regarding this research limitations it is important to note that, due to the limited time available, the study focused primarily on the early stages of the project life cycle. As a result, it was not possible to analyze the actual user experience following the delivery of the projects in question. Therefore, the analysis is based on a comparison between the requirements expressed by users and the solutions proposed by the professionals involved.

Furthermore, the projects studied involved companies and individuals with diverse profiles, leading to different situations and interactions. Given the limited sample size and the qualitative exploratory method employed, the results presented here cannot be generalized. However, they can serve as valuable indicators for the development of future research and for pilot testing of the proposed solutions.

Finally, concerning the data collection, it should be noted that, in qualitative research, the presence of the researcher can influence participants' responses, leading to a reactivity bias. Despite the efforts made to minimize this bias influence on the results, this limitation is inherent to this type of study.

# ANNEX I

## TVD EXPERTS' INTERVIEWS

### ME1 Interview

This interview was held with consultant specialized in collaborative practices and discusses the implementation of TVD in the construction industry, highlighting the importance of aligning the design and construction processes with the budget (target cost) while ensuring that the project meets the client's value expectations. Some main themes were highlighted in the discussion:

*Importance of Collaborative Design:*

Emphasis is placed on the need for integrated design processes that involve all stakeholders, including architects, engineers, and the end-users (clients). Collaboration is essential to align the project scope, budget, and timelines effectively.

The use of co-location (having all team members work in the same physical space) is highlighted as crucial for successful collaboration, though it is noted that hybrid meetings (online and present participants) can be less effective.

*Challenges in TVD Implementation:*

Differences in organizational culture and resistance to change are significant barriers. There is often a disconnect between what the client needs and how the design team interprets those needs. Other major challenge is ensuring continuous estimation and adjusting the design to stay within the target cost, which requires close collaboration between estimators and designers.

The conversation underscores the difficulty in integrating continuous feedback loops (iterations) into the traditional construction process, which is usually more rigid and segmented. As well as the critical role of estimators in the TVD process and the benefits of iterative, short cycles in project development.

*User Involvement:*

The interviewee stresses the importance of involving clients and end-users in the design process to ensure their needs are met. This includes regular workshops and facilitation to align project values with client expectations.

*Role of Target Costing:*

TVD involves setting a clear target cost early in the project, which guides the design and construction process. This is contrasted with traditional approaches where cost overruns often lead to value engineering that can diminish the project's value.

The role of the client is crucial in defining the target cost, but there is also a need for the entire team to understand and commit to this target.

*Lessons Learned and Best Practices:*

Successful TVD projects often involve early and frequent engagement with all stakeholders, including end-users, to capture their needs and ensure the project delivers the intended value.

The use of agile methodologies, such as Scrum, is recommended for short iteration cycles, enabling continuous feedback and adjustments. Training and change management are essential to help teams transition from traditional project delivery methods to TVD.

*Case Studies and Real-Life Examples:*

Specific projects are mentioned where TVD was implemented successfully, but also cases where it failed due to poor implementation of key principles such as target cost setting, lack of co-location, and insufficient stakeholder engagement.

The conversation also touches on the broader adoption of TVD in certain regions, noting that success is often dependent on the client's willingness to support and drive the TVD approach.

**ME2 Interview**

This interview was conducted with a construction industry professional who has worked on large-scale projects both industrial and commercial ones. They have a deep understanding of TVD and have applied its principles in different project contexts.

*TVD Implementation in Large-Scale Projects:*

The interviewee discusses their experience implementing TVD in a large industrial project in Alberta. From their experience These projects often start with incomplete designs, and the contractor is involved early in the process to assist with estimating and managing costs as the design evolves.

TVD is applied with an iteratively estimating costs process as the construction progresses, allowing for real-time adjustments to design and scope to meet budgetary constraints. The modular approach to construction in these projects also facilitates the application of TVD principles, enabling more controlled and manageable sections of work.

*Challenges of TVD:*

A significant challenge mentioned is the complexity of decision-making in large projects with many stakeholders. The interviewee notes that delays in decision-making can negatively impact the project's schedule and budget. They emphasize the importance of having clear structures and processes for decision-making to mitigate these issues. Another challenge is the availability of accurate and timely information, which is critical for making informed decisions throughout the project.

*Collaborative Practices:*

The interviewee highlights the importance of collaboration, particularly the use of co-location (having all stakeholders in the same physical space) to enhance communication and decision-making, bringing team members from different organizations to work closely together, leading to better project outcomes.

The use Building Information Modeling (BIM) and the Last Planner System is also discussed as crucial for ensuring effective collaboration and planning in TVD projects.

When questioned specifically about the user involvement in construction projects the interviewee said: "I think not involving him is a mistake, involving him too much is a mistake too."

*Modular Construction and TVD:*

The interviewee mentions how modular construction methods align well with TVD principles. In their experience, working with modules allowed for more controlled and systematic project execution, as each module could be fully designed, estimated, and constructed within a specific budget before moving on to the next.

*Success Factors and Best Practices:*

The interviewee emphasizes that successful TVD requires a strong commitment to transparency, iterative processes, and collaboration. They also stress the importance of having a well-defined and agreed-upon process for estimating and managing costs, which helps to keep all stakeholders aligned with the project's financial goals.

Additionally, the interviewee notes that a focus on health and safety can serve as a unifying factor for teams, creating a culture of care and responsibility that supports overall project success.

*Lessons Learned:*

The interview includes reflections on projects where TVD was not fully successful, often due to a lack of adherence to its principles or a reversion to traditional methods. These experiences underscore the importance of cultural change and the need for continuous improvement in applying TVD.

**ME3 Interview**

This interview was conducted with a professional from a general contractor company. They have significant experience with IPD and have participated in multiple TVD projects. The conversation focuses on the nuances of implementing TVD in construction projects, the challenges associated with the process, and the importance of collaboration and accurate cost estimation.

*Challenges in TVD Implementation:*

One of the key challenges highlighted is the need for accurate and realistic cost estimates early in the project. He notes that many construction projects struggle with setting target costs because they rely on outdated or inaccurate data, which can lead to discrepancies between the estimated and actual costs.

He also discusses the difficulties in changing the traditional design process to incorporate the expertise of specialized contractors early in the project. This integration is crucial for TVD to be successful, but it requires a shift in mindset and practice within the industry.

*Collaboration and Cultural Change:*

The interviewee emphasizes the importance of collaboration between designers and contractors. He argues that successful TVD requires a cultural shift where designers are more open to incorporating feedback from specialized contractors, which can significantly improve the accuracy of cost estimates and the overall quality of the project.

They mention that the traditional hierarchical structure in construction, where subcontractors are often viewed as less important, needs to be rethought. Instead, subcontractors should be seen as partners who contribute with valuable knowledge and expertise. The interviewee added: “If people are not able to recognize the value of the expertise of the trades and if designers aren't prepared to listen to what the electricians have to say, what the plumbers have to say, what the sheet metal people, the structural directors, the people who make the formwork have to say, the TVD doesn't work.”

*Real-Life Examples:*

The interview includes discussions of specific projects where TVD was applied. For example, a high school project that won an award for its successful value delivery for the users by applying Lean and TVD principles. This project however represented a problem for the governmental representative because it presented a higher square feet price than most projects. They also share examples where projects faced challenges due to poor alignment between cost estimates and project goals. He highlights a case where a project failed because the target cost was set unrealistically low, leading to a situation where the design could not be completed

within the budget. This underscores the importance of setting realistic and achievable targets in the TVD process.

*Lessons Learned and Best Practices:*

The interviewee advocates for early involvement of contractors in the design process to ensure that cost estimates are based on current market conditions and real-world constraints. He also stresses the need for ongoing collaboration and communication throughout the project.

He suggests that one of the keys to successful TVD is to focus on value optimisation continuously during both the design and production phases. This approach can help teams identify cost-saving opportunities without compromising the quality or functionality of the project.

*Impact on Project Outcomes:*

The interview discusses how TVD can lead to better project outcomes by aligning the project's design with the owner's values and goals. By involving all stakeholders early in the process, TVD helps ensure that the final product meets the expectations of both the owner and the end-users.

The interviewee also touches on the role of government and public sector clients in the TVD process, noting that their involvement and understanding of the process are crucial for the success of public projects.

This interview emphasizes the importance of collaboration, accurate cost estimation, and cultural change within the industry. The discussion also underscores the need for early contractor involvement and the continuous refinement of cost estimates to achieve the best possible outcomes for the client and end-users.

**ME4 Interview**

The professional interviewed here is experienced in IPD projects and former Vice President of Strategy and Innovation at general contractor company.

*TVD implementation:*

The interviewee describes TVD as a process that focuses on designing to a detailed estimate rather than estimating a detailed design. This approach requires creating a realistic and detailed estimate early in the project and then designing within those financial constraints.

He emphasizes the importance of breaking down the estimate into functional areas aligned with project implementation teams, allowing for tighter feedback loops between design and cost considerations.

They suggest that successful TVD implementation hinges on two key factors: a comprehensive set of values and goals, and a highly detailed budget that accounts for all assumptions. The importance of selecting a cohesive and collaborative team and the need for ongoing cultural training to maintain team alignment throughout the project is also stressed.

*Challenges in TVD:*

They mention that while the concept of designing to a detailed budget is strong in theory, it struggles in practice due to teams often rushing into design before fully developing the estimate. This leads to the cycle of design, pricing, and redesign, which TVD aims to avoid.

He also points out that many teams do not spend enough time setting detailed and accurate target budgets, which undermines the effectiveness of TVD. Teams often fail to take full ownership of their budgets, relying too heavily on contractors' estimators.

*Advantages of TVD:*

Beyond cost management, the interviewee highlights that TVD promotes balanced decision-making by considering a broader set of values and goals established at the beginning of the project. This holistic approach increases the likelihood that the project will meet the owner's expectations across various metrics, not just cost.

TVD is also saw enhancing collaboration among the project team, leading to more cohesive and integrated project delivery.

*User Involvement:*

The interview emphasizes the importance of involving end-users early in the process to ensure that the design supports their activities effectively, adding that this factor was not a problem in the projects that they participated. Various methods for engaging users are mentioned, such as interviews, surveys, simulations, and mock-ups.

*IPD vs. Traditional Project Models:*

The interview touches on the differences between IPD and traditional project delivery models, noting that TVD is most effective in IPD environments due to the high level of collaboration and integration.

For they while TVD can be adapted to design-build and construction management projects, it is challenging to implement in traditional design-bid-build models due to the separation of design and construction phases. They present their thoughts in the traditional approach concerning the end-users: “I think that in traditional project delivery the relationship between what the users want and what the design team is asked to design, there's a lot of gaps in there.[…] I think the majority of buildings that get built where the end users are unhappy are more traditional models where they're segregated and separated from the designers and the construction team.”

**ME5 Interview**

This section features an interview with a director in collaborative delivery at a general contractor company, with experience in IPD and TVD across multiple sectors, including healthcare, education, and industrial projects.

*TVD Implementation:*

They emphasize the importance of early and continuous engagement with owners to align project goals and expectations with the target cost. They discuss how different project contexts, such as public vs. private, can influence the effectiveness of TVD.

*Challenges in TVD:*

A major challenge highlighted is the cultural shift required for TVD, as it involves a different mindset from traditional project delivery methods. Ensuring that all stakeholders, including owners, designers, and construction teams, are fully committed to the TVD process is crucial. Iterative estimating is another significant challenge. The need for real-time cost data and continuous communication between estimators and the rest of the project team is essential for maintaining alignment with the target cost throughout the project. Finally, the owner's evolving requirements and the lack of early clarity on the project's scope can bring a project to fail.

*Success Factors:*

Communication and iterative estimating are identified as critical factors for successful TVD. The importance of integrated teams and early involvement of all stakeholders, including end-users, is mentioned to ensure that the project meets the owner's goals and stays within budget. TVD is praised for providing cost certainty and avoiding the pitfalls of traditional "value engineering," which often leads to cost-cutting at the expense of project value.

*User Involvement:*

The interview emphasizes the importance of user involvement in the TVD process. Different strategies for engaging users are presented, depending on the project's complexity and the owner's knowledge of the end-users' needs. The need for flexibility and the use of stakeholder engagement best practices to gather and incorporate user feedback effectively is highlighted.

*Lessons Learned:*

The interview concludes with a discussion on lessons learned, particularly the need for strong communication, effective team integration, and iterative estimating. The interviewee also points out the dangers of working in silos, as it can lead to misalignment with the target values and overall project goals.

The examples shared illustrate both the successes and challenges of implementing TVD, offering useful lessons for future projects. The role of user engagement and the need for

flexibility in the process are also highlighted as critical elements for delivering value to the final user.

**ME6 Interview**

The interviewee has extensive experience in delivering IPD projects. He has been involved in multiple sectors projects, including healthcare, education, recreation centers, and industrial buildings. The interview highlights the practical challenges, benefits, and methodologies associated with TVD in construction projects.

*Implementation of TVD:*

TVD has been applied across a wide range of projects, including hospitals, universities, and residential buildings. The interviewee emphasizes that TVD is crucial for ensuring that projects stay within budget while meeting the owner’s expectations and delivering value.

*Challenges in TVD:*

A significant challenge in implementing TVD is the cultural shift required among project teams. The process is counterintuitive to traditional construction methods, and success heavily depends on the team's ability to absorb and adapt to this change.

The interviewee points out that change management is critical in TVD, as it involves shifting mindsets and ensuring all stakeholders are aligned with the project's goals.

*Success Factors:*

Iterative estimating and continuous engagement with all stakeholders, including end-users, are highlighted as key factors in the successful implementation of TVD. The process involves a shift from traditional methods where the building design is static and the budget fluctuates, to a method where the budget is fixed, and the building design is flexible.

The interviewee also emphasizes the importance of educating and training the construction team to maintain the focus on TVD principles throughout the project's lifecycle.

*Real-Life Examples:*

The interviewee shares several examples where TVD has been critical to project success. For instance, in a hospital project, an innovative idea from an electrician led to significant cost savings, which allowed the project to include additional valuable features.

Another example involved a recreation center where the team was able to add value by efficiently managing the project, delivering it ahead of schedule, and incorporating additional features that were not part of the original plan.

*User Involvement:*

The interviewee stresses the importance of involving end-users in the TVD process. Consulting with users, either through direct participation in workshops or through preliminary consultations, is crucial for accurately capturing their needs and ensuring the project delivers the intended value. When questioned about the user participation in the value definition the interviewee said: “I wouldn't recommend doing a values exercise without at least having consulted with the Community or the end users and if you haven't consulted with them, I'll bring them into the room the day of the workshop.”

*Lessons Learned:*

The lessons learned from various projects, include the importance of ongoing training and education for teams, especially during the construction phase. Failure to educate the construction team on TVD principles can lead to costly mistakes and reduce the overall effectiveness of the process.

The interview highlights the importance of change management, iterative estimating, and user involvement. It also underscores the critical role of ongoing education and training in ensuring that TVD principles are effectively implemented throughout the project lifecycle.

# ANNEX II

# IMPROVING VALUE IN INTEGRATED PROJECT DELIVERY

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## Abstract

The urgency to enhance building project delivery has driven the built asset industry to develop innovative methods for design and construction. Among these approaches, Target Value Delivery (TVD) has gained significant attention. TVD seeks to harness the capabilities of a multidisciplinary team to optimize project efficiency and resource utilization. While TVD has demonstrated promise in reducing waste, its capacity to address other value delivery aspects has not been tackled, among them the alignment with user needs. This paper presents preliminary findings from a constructive design research study that investigates the integration of TVD with complementary methodologies, including Lean Led Design (LLD) and the Integrated Design Process (IDP). The research conducts a comparative analysis of IDP as a standalone process versus its combined application with LLD. Preliminary results show a better alignment with the functional requirements of the organization and its users when IDP is coupled with LLD. This synergy has the potential to enhance project delivery by harmonizing design and construction processes with user needs, expanding the scope of value delivery beyond waste reduction.

## Introduction

As the built asset industry evolves, so do the demands related to it. The constant search for the delivery of highly complex, yet sustainable projects within specific time and budget constraints requires novel approaches. Among these, participative, lean and value focused approaches are growing in popularity due to their potential to efficiently tackle the difficulties faced by

construction companies. Target Value Delivery (TVD) is a Lean approach to project management that aims to deliver customer value within project constraints (Ballard, 2020). TVD differs from traditional processes such as the briefing process or project management processes put forward by organizations such as the Project Management Institute (PMI), as it involves setting a Target Cost based on customer expectations and budget, at earlier project stages, thus reducing waste, rework, and loss of quality. The value achievement benefits of TVD lies in the continuous improvement mentality, that addresses the challenge of reducing cost while increasing project value (Miron et al., 2015). According to Shillito & DeMarle (1992) the value of a product or service is the need for it times its ability to satisfy this need over its cost, the clear definition of needs is therefore essential for obtaining a solution with added value, the final goal of TVD.

The attainment of TVD goals depends largely on the collaboration and commitment of the project stakeholders (Rybkowski et al., 2022; Swenson, Ansari, Bell, & Kim, 2003). They play a crucial role in both setting project's value and proposing innovative solutions to achieve it. However, the great challenge brought by the subjectivity of value, one of the main challenges with the TVD implementation is the greater focus on cost (Miron et al., 2015). This point can be a lever, driving the TVD implementation in a project, but when organizations focus largely on cost reduction to increase solely their profits, the addition of value is put aside. This research explores the use of Integrated Design Process (IDP) and Lean Led Design (LLD), with the goal of enhancing project value through improved stakeholder participation.

**Literature review**

When we look at TVD from the perspective of the value added to the projects, we understand the subjectivity that TVD brings, since the understanding of the value concept is extremely relevant, and the latter is relative and dependent on the experience and characteristic of each of the various stakeholders in a construction project (Drevland & Tillmann, 2018). The capture of these values, in addition to the clear definition of the project vision, depends on the great clarity on the part of the client and user in defining their needs, as well as the designers' ability

to capture and transform these needs. Therefore, the participation of all key stakeholders at the beginning of the project definition becomes important.

Although many construction projects experienced great advantages in having the user contribution (Chbaly, 2022; Hicks, McGovern, Prior, & Smith, 2015; Schouten, Heusinkveld, Van Der Kam, & Benders, 2020), the built asset industry still fails to integrate the user in most of the projects. The user participation has not yet been thoroughly explored in the project definition of high complexity assets. Among the reasons, we can point out the lack of understanding of the client's business challenges, the focus on technical requirements by the design team and the lack of clarity of their own needs. Various approaches have been proposed and help identify design solutions that will maximize value generation. This paper explores through case studies two approaches to enhance client's stakeholders' participation: Integrated Design Process (IDP), and Lean-Led Design (LLD).

The original aim of IDP is to develop high performance building using an integrative and iterative approach to building design (Forgues & Dionne, 2015). It is now recognized as a collaborative design approach process that involves the participation in design charrettes of the client, a master team and a proponent team (Société québécoise des infrastructures, 2016) during the project definition. The goal is to find and agree on innovative solutions to address technical or functional challenges related to ambitious objectives. This approach can involve other participants, whether they are experts in some domain, consultants or even the future users of the construction (Forgues & Dionne, 2015).

The success of Lean Led Design was demonstrated in hospital projects (Forgues, Brunet, & Chbaly, 2018). This approach involves the implementation and use of Lean techniques to map the operational flows and understand their impact on the space configuration of the built asset. Thus, the success in planning hospitals is evidenced by the reduction of time and effort spent by employees and the increases efficiency and efficacy to perform their daily activities. The LLD "affects the processes, systems and everyday activities that people will improve in an

ongoing basis" (Grunden & Hagood, 2012, p. 52). TVD, IDP and LLD are synergetic approaches. Their combined use has the potential to generate more value for the various stakeholders of a project. The above-mentioned synergy has not yet been fully explored, especially when it comes to the user involvement. These considerations bring the question: How to maximize users' contribution in the project definition phase?

**Research method**

Constructive research method explores real problems of sufficient relevance and seeks to solve them in practice using a related theory to the problem (Lukka, 2003). Considering the complexity of the problem and the need to consider different types of data and perspectives(Lehtiranta, Junnonen, Kärnä, & Pekuri, 2016) the constructive research method was considered the most adapted to this study. Koskela's Transformation-Flow-Value (TFV) theory (Koskela, 2000), which involves three views in design tasks, provides a basis for selecting and analyzing construction projects in this value setting context and guided the data collection. The data collection strategy used to explore the applications of the value concept within participatory methodologies was the observation of two case studies. Both cases were carried out in educational institutions.

For Case 1, LLD was realized in parallel to a IDP process, In Case 2 it was imbedded in the IDP. This first phase of this exploratory research comprised an analysis of documents, observations of workshops and interviews with participants (Table A II.1). The data collected was coded in a descriptive manner inspired by Miles & Huberman (1994) and considered the TFV theory, the value measurement criteria, and the project's history. This data organization enabled the comparative analysis of the alignment of such projects with the user's needs, as well as their implementation of TVD principles.

Table A II.1 Data analyzed

| Type of data | Case 1 | Case 2 |
|---|---|---|
| Workshop observations | 9 workshops (7 IDP workshops and 2 Kaizens) | 8 workshops (7 IDP workshops and 1 LLD) |
| Documents analyzed | Design propositions, meeting reports, design assessment grid, project description documents, interview transcripts, etc. | Design propositions, meeting reports, matrix of functional links, project description documents, government requirements documents, etc. |

**Findings**

Although the present study is still under development Case1 preliminary results showed a misalignment between functional program and user real needs (Table A II.2). The active inclusion of the user during the design allows the professionals to extract user needs in real time. When comparing Case1 and Case 2, there is a greater alignment with the user's needs in Case 2, although they did not participate directly in the process, their needs were clear in the minds of the stakeholders thanks to the simulation of real situations made in the LLD workshops. Whereas in Case1, there is a need for rework from the designers to adjust the project to new requirements.

Table A II.2 Case 1 requirements comparison

| Observed criteria | Program requirements | Real need defined by users |
|---|---|---|
| Laboratory quantity | 30 | 16 |
| Number of offices | 42 | 79 |
| Total Surface | 6510 m² | 5854 m² |

## Conclusions

The integration of the IDP with LLD and TVD methods presents a promising avenue for enhancing value delivery in construction projects. This research is part of a broader approach aimed at creating a value management framework in an IPD or TVD mode, it underscored the importance of aligning project processes with user needs, demonstrating that while IDP alone offers collaborative benefits, its synergy with LLD can significantly enhance project outcomes. The iterative nature of LLD workshops enables professionals to simulate user interactions and refine designs, accordingly, leading to greater alignment with user needs.

In essence, by integrating TVD with complementary methods such as LLD and IDP, construction projects can achieve not only improved efficiency and resource utilization but also enhanced value delivery that prioritizes user needs.

**The Bibliography section is presented at the very end of the thesis.**

# ANNEX III

## ADDING VALUE TO CONSTRUCTION PROJECTS: HOW A PARTICIPATORY APPROACH CONTRIBUTES TO EFFECTIVE VALUE SETTING

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**Abstract**

The urgency to enhance building project delivery has driven the built asset industry to develop innovative methods for design and construction. Among these approaches, the Integrated Design Process (IDP) has gained significant attention. IDP seeks to harness the capabilities of a multidisciplinary team to optimize project efficiency and resource utilization. While IDP has demonstrated promise in reducing waste, its capacity to address other value delivery aspects has not been tackled, among them the alignment with user needs.

This paper presents preliminary findings from a constructive design research study that investigates the integration of IDP with complementary methodologies, including Lean Led Design (LLD) and Target Value Delivery (TVD). Focusing on the initial phase of large-scale complex projects in Quebec, Canada.

The research conducts a comparative analysis of IDP as a standalone process versus its combined application with LLD. Preliminary results show a better alignment with the functional requirements of the organization and its users when IDP is coupled with LLD. This synergy has the potential to enhance project delivery by harmonizing design and construction processes with user needs, expanding the scope of value delivery beyond waste reduction.

## Introduction

As the built asset industry evolves, so do the demands related to it. The constant search for the delivery of highly complex, yet sustainable projects within specific time and budget constraints requires novel approaches. Among these, participative, lean and value focused approaches are growing in popularity due to their potential to efficiently tackle the difficulties faced by construction companies. Target Value Delivery (TVD) is a lean approach to project management that aims to deliver customer value within project constraints (Ballard, 2020). TVD differs from traditional processes such as the briefing process or project management processes put forward by organizations such as the Project Management Institute (PMI), as it involves setting a target cost based on customer expectations and budget, at earlier project stages, thus reducing waste, rework, and loss of quality. The value achievement benefits of TVD lies in the continuous improvement mentality, that addresses the challenge of reducing cost while increasing project value (Miron et al., 2015).

The attainment of TVD goals depends largely on the collaboration and commitment of the project stakeholders(Rybkowski et al., 2022; Swenson et al., 2003). They play a crucial role in both setting project's value and proposing innovative solutions to achieve it.

In the initial stages of a construction project, its value is often unclear, and each stakeholder may have a different perception of what it should be. Therefore, to ensure a precise and clear definition of value, and the production of a solution tailored to user needs, it is essential to foster effective collaboration among all stakeholders, users included.

This research will explore the use of the lean led design (LLD) and the integrated design process (IDP), with the goal of enhancing project value through improved stakeholder collaboration. The analysis presented focus on the early stages of a complex construction project, with a particular emphasis on how the project responds to user needs. Thus, helping to bridge the existing gap regarding the pertinence of user involvement in the earlier stages of a project for value generation. Furthermore, this paper provides some insights about promising tools and processes to facilitate the target value setting in this context.

This study begins with an extensive literature review, aiming to substantiate the key concepts linked to the methodologies analyzed, as well as the concepts supporting value generation. Subsequently, the methodology used is presented, containing information regarding the process followed for the development of the analyses. Section 4 presents a description of the cases studied, followed by the presentation of the results and discussion in section 5. Finally, section 6 presents the conclusions of this study, and section 7 outlines its limitations.

## Literature Review

### Target Value Delivery

The interest and application of TVD have been increasing, as the search for more effective constructions and the constraints of time and cost increase. In fact, the concept behind Target Value Delivery has its origins in the Target Costing from the manufacture sector(Karaz & Teixeira, 2023; Ballard, 2012). This evolved and was adapted over the years, being applied for the first time in the construction domain with the name of Target Value Delivery (Malvik et al., 2021 b). Although the application of TVD has increased, the reports on the application of the concepts are mostly vague and focused on cost reduction. Therefore, an analysis of the other key guideline of the method is necessary.

When we look at TVD from the perspective of the value added to the projects, we understand the subjectivity that TVD brings, since the understanding of the value concept is extremely relevant, and the latter is relative and dependent on the experience and characteristic of each of the various stakeholders in a construction project(Drevland & Tillmann, 2018). The capture of these values, in addition to the clear definition of the project vision, depends on the great clarity on the part of the client and user in defining their needs, as well as the designers' ability to capture and transform these needs. Therefore, the participation of all key stakeholders at the beginning of the project definition becomes important.

Besides the great challenge brought by the subjectivity of value, one of the main challenges with the TVD implementation is the greater focus on cost (Miron et al., 2015). This point can be a lever, driving the TVD implementation in a project, but when organizations focus largely on cost reduction as means to increase solely their profits, the addition of value is put aside.

Although many construction projects experienced great advantages in having the user contribution (Chbaly, 2022; Hicks et al., 2015; Schouten et al., 2020), the built asset industry still fails to integrate the user in most of the projects. The user participation has not yet been thoroughly explored in the project definition of high complexity assets, Smoge, Torp, & Johansen (2020) however mentions that user interventions tend to bring more complexity to the designers' job.

Among the reasons for this increase in complexity, we can point out the lack of technical knowledge, lack of comprehension of the proposition and still a lack of clarity of their own needs.

**Integrated Design Process**

The importance of stakeholder participation in projects has driven the development of several studies and then the implementation of participatory approaches. Among the various approaches, we find in Quebec the use of the Integrated Design Process, for big government projects, and some hospital projects carried out in Lean Led Design. Both approaches are used from the project definition stage as a means of collecting the capabilities of multidisciplinary teams to carry out projects optimized in terms of efficiency and resource use.

The IDP is a process that inevitably involves the participation of the client, a master team and a proponent team (Société québécoise des infrastructures, 2016) during the project definition and conception phase. The stakeholders can thus collaborate to propose improvements and changes rapidly and effectively, considering the vision of all participants. This approach can involve other participants, whether they are experts in some domain, consultants or even the future users of the construction (Forgues & Dionne, 2015).

**Lean Led Design and Kaizen**

The success of Lean Led Design was demonstrated when used in the construction of hospitals(Forgues et al., 2018), the approach involves the implementation and use of lean techniques to mainly understand the flows within the built asset. Thus, the success in planning hospitals is evidenced by the reduction of time and effort spent by employees to perform their daily activities. The situation faced by nurses and doctors in hospitals, although quite specific, is similar to the routine of teachers, students and staff in a school, who must move between the different zones of the same building or campus to carry out their activities.

The Kaizen is a part of the many lean tools and can be used to the application of the LLD approach(Chbaly, 2022) in an event manner. It differs from LLD due to its precise focus on problems and process. The LLD in the other hand “affects the processes, systems and everyday activities that people will improve in an ongoing basis”(Grunden & Hagood, 2012, p. 52)

It is indisputable that each of the approaches presented above has positive points. However, the individual use of each one does not guarantee the best value delivery, the combination of them, however, has a great potential to address the needs of a complex project, which include many stakeholders such as hospitals and schools.

TVD, IDP and LLD are synergetic approaches. Their combined use has the potential to generate more value for the various stakeholders of a project. By combining the collaborative process of IDP with the user empowerment enabled by LLD, the determination of the project value can be carried out more quickly and accurately. With a clear determination of value and the inclusion of all stakeholders in the process, the application of TVD has greater chances of success.

The above-mentioned synergy has not yet been fully explored, especially when it comes to the user involvement. These considerations bring the question: How can the users contribute to the project definition phase?

**Research Methodology**

Participatory methods are being recognized as innovative solutions for executing projects within a set time and budget, while also enhancing the quality. These methods ensure that both clients and project stakeholders receive added value. However, one aspect that often gets overlooked when these methods are applied is user involvement. Furthermore, the means of collaboration are not standardized, which can lead to inconsistencies in the application of these methods.

To explore the different results obtained while applying different participatory methods and improve the delivery of value to the user in projects carried out in this context, the constructive research approach was chosen. Indeed, this research method explores real problems of sufficient relevance and seeks to solve them in practice using a related theory to the problem (Lukka, 2003). Koskela's Transformation-Flow-Value (TFV) theory (Koskela, 2000), which involves three views in design tasks, provides a basis for selecting and analyzing construction projects in this value setting context and guided the data collection.

The possibility of using multiple methods, techniques and tools for the inquiry is one of the greater benefits of using the constructive research method, as it allows the capture of different types of data and perspectives(Lehtiranta et al., 2016). Following the structure of this type of research, a first exploration of the literature was done, seeking to identify factors that could contribute to a better use of TVD, when proceeding in this exploration a gap was identified in the definition of value and potential for improvement is in the application of participatory processes for value delivery. The literature review and data collected from other studies helped define empirical criteria for value generation measurement in projects, such as the decrease in square meters required to meet needs and the reduction in the gap between needs and the

functional program of the facility. These tangible measures can be impacted during the design phase.

The research strategy used to explore the applications of the value concept within participatory methodologies was the observation of two case studies. Both cases were carried out in educational institutions under the same municipal and state rules and restrictions, using the IDP. The differentiation between them is determined by the use or non-use of Lean Led Design (LLD).

This first phase of the research comprised an analysis of documents, observations of workshops and interviews with participants (Table A III.1). The data collected was coded in a descriptive manner inspired by Miles & Huberman (1994) and considered the TFV theory, the value measurement criteria, and the project's history. This data organization enabled the comparative analysis of the alignment of such projects with the user's needs, as well as their implementation of TVD principles.

Table A III.1 Data analyzed

| Type of data | Case 1 | Case 2 |
|---|---|---|
| Workshop observations | 9 workshops (7 IDP workshops and 2 Kaizens) | 8 workshops (7 IDP workshops and 1 LLD) |
| Documents analyzed | Design propositions, meeting reports, design assessment grid, project description documents, interview transcripts, etc. | Design propositions, meeting reports, matrix of functional links, project description documents, government requirements documents, etc. |
| Conducted interviews | 9 semi-structured interviews with different stakeholders | 6 semi-structured interviews with different stakeholders |

**Case Study**

In this section, an overview of the cases used as a basis for the discussions presented in this article will be provided.

**Case 1**

Case 1 described here is the project definition stage of a set of university buildings. The project started in 2021 with consultation of the university teachers. In a Kaizen workshop, the users of the new area defined their vision for the new zone. Also, in this phase of the project, their requirements were defined.

The values and vision established in the Kaizen workshop was then communicated to the designers and consultant team, in the first IDP workshop, that occurred in 2022. The IDP process had the presence of the architects, engineers, project owner, project management representative and the IDP facilitator.

In the IDP process a series of workshops was held, the first one concerning the vision, objectives, issues, and challenges of the project. In the sequence some technical workshops were held and finally a series of real estate development and analysis workshops took place. The later ones concerned the presentation of different options by the designers, the gathering of participants' comments and the incorporation of the improvements in the options.

The IDP workshops for this project phase finished in the 2023 spring, at this moment a general idea of the group of buildings was defined, and the architects proposed one solution of functional program that would suit the users' requirements defined in the beginning of the project.

At the summer 2023, a new Kaizen was held with the users; at this stage the teachers presented their actualized requirements in terms of functionality and space needed. They also used a view of the solution proposed by the architects to show their needs and how they could add their vision for the project in the area proposed.

**Case 2**

The second case studied started as a renovation and expansion of a secondary school. The school, built in 1962 and expanded twice, in 1977 and 2016, required an adaptation to the new pedagogical methods and the government directives for public schools within the province.

The project started with the use of the IDP approach in 2020, with the participation of the main stakeholders knew at the time, engineers, architects, consultants, and the owner. The first IDP phase had the goal of establishing the project vision and objectives and explore the main difficulties for the renewal and expansion of the school within the site, budget, and time restrictions. This process was carried out for a few months and comprised four workshops. At the end of this phase, a final option would be selected, but due to all the constraints of the site and the needs established by the new guidelines, the decision to build a new school was made. The process resumed in 2022, after several negotiations regarding the new school had taken place.

The second part of the process, initiated in August 2022, relied on the use of the IDP approach and the LLD. This last one was brought with the objective of improving the concept of the school and allow better needs definition by the client. Thus, reducing the amount of change that might be requested in later stages of the project.

The LLD process was used in four specific workshops. The first workshop explored user habits concerning school access, where stakeholders discussed strengths and weaknesses of different options for school location and access. In the second workshop, simulations of circulation for different user profiles were made to develop a better tool for visualizing the circulation and proximity of zones in the school. The third workshop was used to validate the needs and assess problems with the concept before the tender process, providing a clearer definition of requirements to the bidder.

After the three LLD workshops and the tender process mentioned above, the process continued mainly with the use of IDP workshops. With the participation of the stakeholders from the previous stages and the bidder. These workshops took place on a weekly basis and included a presentation of the progress made in the design, as well as discussions about improvements to be made, which were openly discussed by all the participants, including the client.

The fourth and last LLD workshop was mainly focused on the validation of the design solution proposed. The discussion was once again guided by simulating user trajectories inside and outside the school, to identify potential issues to be solved prior to the project approval process.

**Results and Discussion**

Although TVD can be used throughout the entire project life cycle, as shown in Figure A III.1, the cases explored and results presented consider the upstream project phases, in which value definition takes place and LLD is used.

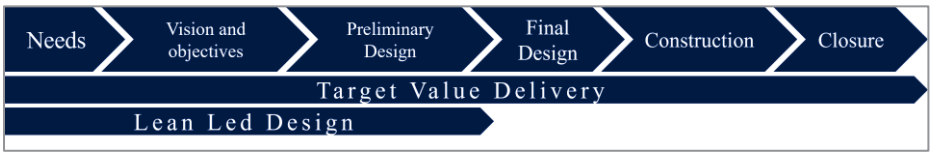


Figure A III.1 Life cycle of project and TVD and LLD phases of influence

From the observations of the two cases studied, it was possible to verify that the use of IDP and LLD fostered the development of a collaborative environment with high stakeholder engagement, as well as user empowerment for better alignment of the project with their needs. These factors are part of the minimum components for a clear definition of the project value, and contribute significantly to the implementation of many of the 17 key TVD practices for the success of a project (Ballard, 2011).

This section will describe how each of the factors was fostered in the projects observed and will present how these factors relate to specific TVD practices.

Table A III.3 presents a summary of the observed factors, the related TVD practices, and a small description of their implementation, allowing for a more precise comparison of how the use of LLD with IDP can contribute to a greater value delivery.

**Collaboration**

The IDP projects executed in Quebec rely mostly on the use of the Big Room in their collaborative process. It is known that within this environment the collaboration is facilitated as all the key stakeholders are present, working in the same room (Jones, 2014), and sharing

their understanding of the business case and the stakeholder values. Although the strategy taken in the planning of the workshop has a great influence in the quality of the collaboration. Both projects had the same Big Room type structure to stimulate collaboration. However, the IDP workshops observed for the Case2 were characterized by more fluidity in discussions. The Case1 workshops were characterized by long periods of presentation, in which only one of the participants spoke, and short moments of interaction between the other stakeholders, who had a few minutes to offer their comments. Case 2, on the other hand, had very few sessions with only presentations and most of the workshops had the participation of the stakeholders questioning and making suggestions regarding the project. It is important to notice that this case was also supported by a relational type of contract, that is known to drive collaboration.

The participation of the stakeholders in the discussion about the project can be a proof of a better understanding of the project goals and so a better collaboration to achieve this goal, this proof, however, cannot be, at this stage, directly attached to the use of the Lean Design implementation, as there is a lack of information concerning the primary workshops realized in the Case2, before the incorporation of the Lean approach.

**User involvement**

The main goal of the LLD is to provide an asset adapted to the user needs. This is, however, a challenge as most of the high complexity projects have a great multiplicity of users. Both cases analyzed sought the user view. The first one by incorporating in the process parallel workshops with the university professors to capture their needs and the second one by making simulations of the users' interaction with the asset.

The level of user involvement in both processes is though low, as their participation is either informative or consultative(Caixeta, Tzortzopoulos, & Fabricio, 2019), relying on the professional's interpretation of their needs and requirements. Although there is a search for user inclusion in the process, the cases do not fully respond to the practice "Customer is a member of the project delivery team", as it requires a more active participation of the user in the process, as one of the members of the project delivery team.

For the Case1, the user initially acts as an informant, in defining their needs and sharing it with the professionals, who interpret the received information and propose a solution that is then

validated by the users. The project decisions were made based on the discussions between client and other stakeholders, resulting in a solution not adapted to the users' requirements.

For the case 2, the initial vision of the project was defined by the documentation provided by the ministry and validated by the project team. The discussions and decisions were held between the same type of stakeholders as the Case1, the difference between the two projects was in the interpretation of the needs. The simulation made in the LLD workshops brought a better understanding of the user needs for both the client and the professionals involved in the project.

Although the present study is still under development Case1 preliminary results showed a misalignment between functional program and user real needs (Table A III.2). The active inclusion of the user during the design allows the professionals to extract user needs in real time. When comparing Case1 and Case2, there is a greater alignment with the user's needs in Case2, although they did not participate directly in the process, their needs were clear in the minds of the stakeholders thanks to the simulation of real situations made in the LLD workshops. Whereas in Case1, there is a need for rework from the designers to adjust the project to new requirements.

Table A III.2 Case 1 requirements comparison

| Observed criteria | Program requirements | Real need defined by users |
|---|---|---|
| Laboratory quantity | 30 | 16 |
| Number of offices | 42 | 79 |
| Total Surface | 6510 m² | 5854 m² |

Although there is a lack of validation that the decisions made by the professionals in Case2 really meet the needs of the users. This project provides indications of how it is possible to add the user's voice in projects that have restrictions related to their direct participation, whether due to confidentiality issues or related to the schedule and budget.

### Stakeholder Engagement

Both projects involved highly committed professionals delivering optimized solutions, conducting discussions about cost, schedule, and quality of the design alternatives, another important TVD practice. To fulfill this principle to its full potential, achieving cost-reduced solutions with high value, it is necessary to engage professionals with respect not only to the project but also to the management methodology.

The adoption of a new project management strategy is not a simple process, it requires time and engagement from stakeholders. Among the factors that contribute to engagement are the good structuring of the process and a clear justification for its implementation.

Indeed, the observations brought the awareness that sometimes the professionals involved do not understand the reasons why a certain methodology is being used, either due to a lack of understanding of the methodology or the difficulty in understanding the complexities involved in the project. In either, a good contextualization of the reasons for the use of an approach should be made explicit, thus facilitating greater clarity, and levelling all participants in relation to the project.

Finally, the good structuring of the process. Many professionals hesitate to adopt such methods because they consider them time consuming. This perception can be justified when the workshops are poorly structured. With the increasing time pressures on construction projects, the creation of long-term workshop planning proves to be outdated. The planning of the workshops should be done in a way that suits the professionals' needs, not the other way around.

### Alignment of the project to the user's need

Among the practices of TVD is the feasibility assessment aligned with the project ends, means and constraints and the definition of ambitious objectives to be achieved. The realization of both depends on the effective establishment of the project values, to ensure a good prioritization of what is desired and define objectives based on this desire.

In projects that serve the general public, such as schools and hospitals, there is great value to be generated by addressing the needs of users. It is seen that the use of LLD allowed professionals in Case 2 a clearer vision throughout the entire design process on how to respond to stipulated needs. The use of LLD with IDP enabled a significant advance in one of the stages that is considered by many as one of the biggest difficulties in the good implementation of TVD, the clear definition of value.

The inclusion of the user's vision, even if carried out through a professional facilitator external to the project, was crucial in creating a design optimized in terms of internal circulation.

The active participation of the user during the process, although not verified in the studied cases, could bring the additional benefit of a faster and more accurate response to questions about their habits, as well as greater ease in updating requirements, thus reducing waste generated in redesign.

Table A III.3 Relation between factors fostered by the approach and TVD practices

| TVD practices observed | Case 1 | Case 2 |
|---|---|---|
| Collaboration | | |
| Common understanding of business case and stakeholder values | The definition of values and the business case was carried out; however, it did not last throughout the project. | The business case was developed based on project values. Some of the elements were inserted into the matrix used as the basis for the development of solutions. |
| Relational contract use | The project was being carried out with the mindset of a design-bid-built process. | A progressive design-build contract was used, favouring collaboration among stakeholders. |

Table A III.3 Relation between factors fostered by the approach and TVD practices(continues)

| | | |
|---|---|---|
| User involvement | | |
| Customer as a member of the project delivery team | Users in an informant role in the conception process, not as an active participant. | The users did not actively participate in the process and was consulted sporadically. |
| Stakeholder engagement | | |
| Discussion about schedule, cost and quality of design alternatives | Big Room discussions analyzed options pros and cons, with a focus on material use and client objectives. | Big Room discussions analyzed option pros and cons, with a focus on material use and adaptation to users' routines. |
| Alignment to user's needs | | |
| Targets set as stretch goals | Ambitious goals for asset performance were defined and drove the proposition of innovative solutions. | Performance objectives for the asset were defined, but project constraints limited the proposal of innovative solutions. |
| Feasibility assessment aligned with ends, means and constraints. | Proposed options were evaluated based on constructive possibilities and location restrictions. | Proposed options were evaluated based on constructive possibilities, location restrictions, and adaptation to user needs. |

**Conclusion**

The integration of the IDP with LLD and TVD methods presents a promising avenue for enhancing value delivery in construction projects. This article has underscored the importance of aligning project processes with user needs, demonstrating that while IDP alone offers collaborative benefits, its synergy with LLD can significantly enhance project outcomes. The iterative nature of LLD workshops enables professionals to simulate user interactions and refine designs, accordingly, leading to greater alignment with user needs.

Moreover, the clear communication of project objectives and rationale for methodology selection emerged as factors contributing for stakeholder engagement, thus a successful implementation of these methodologies.

In essence, by integrating IDP with complementary methods such as LLD and TVD, construction projects can achieve not only improved efficiency and resource utilization but also enhanced value delivery that prioritizes user needs. As the industry continues to evolve, embracing collaborative and value-focused approaches will be paramount in driving successful project outcomes in the built asset sector.

This study explored the benefits of end-user inclusion in educational institutions complex projects using LLD. Future research may include an in-depth analysis of the TVD, LLD integration with IDP, the relevance of end-user involvement in other types of projects, as well as other methods, tools and processes for facilitating end-user involvement.

**Limitations**

The cases explored in this article, although composed of the same types of stakeholders, encompass different people and organizations. Therefore, the conclusions and comparisons presented here do not constitute absolute proof of the benefits of combining the approaches. They provide, however, excellent indicators of the use of participatory methodologies for adding value to users.

**The Bibliography section is presented at the very end of the thesis.**

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