



Article

The Challenges and Advantages of Implementing a Lean-Led Design Approach

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Abstract: Healthcare projects, like other complex projects, begin with a project definition phase, where client needs are identified, and design solutions are proposed. All decisions related to this phase have an important impact on workspace conditions. Nevertheless, traditional methods of project definition management have been proven to be inadequate. An ill-defined project might lead to an increase in hospital-acquired infections or patient mortality. Participatory approaches such as Lean-led Design—in which clients including users play an important role from the beginning—are proposed to address this problem. This paper aims to identify and analyze the advantages and difficulties of Lean-led Design during the project definition process. A single case study was used to explore these issues. The case study chosen was a mega Canadian hospital project that implemented a Lean-led Design approach. Data were collected using archive research and semistructured interviews. This paper will help AEC industry stakeholders to understand the advantages and challenges involved in implementing a Lean-led Design approach. The findings of this study could help architects as well as managers to concentrate their efforts on significantly relevant issues.

Keywords: design briefing; healthcare project; participatory approach; requirement; alignment; stakeholder engagement



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1. Introduction

Project definition covers the earliest stages of a project's lifecycle—the planning, programming, and schematic design stages—when client requirements are established and design solutions are developed accordingly [1]. Project definition has different aliases such as “design briefing,” “client briefing,” “front-end loading,” “front end planning,” “pre-project planning,” and “fuzzy front end” [2–5]. It is considered one of the most important phases in a project life cycle [6,7].

Defining and translating client requirements into design solutions is difficult in hospital projects [8]. In such projects, the identification of client needs becomes increasingly complex due to the extensive interactions between the social and technical requirements of these settings [9]. A variety of clients have to interact in the new environment, including users, managers, and funders; every client has their own needs, interests, and objectives, which may possibly be in conflict with those of other stakeholders [10]. The needs identified during the project definition stage tend to evolve over time. Technology is developing rapidly, and hospital workspaces must adapt to this trend [11]. The healthcare industry is undergoing various transformations regarding its physical environment; and new construction plus renovations of existing hospitals are popular.

In such sensitive situations, an ill-formed project definition may have an important impact on workplace safety. A nonoptimal work environment might cause medical errors or hospital-acquired infections, one of the main causes of patient death in the USA [12].

Having said that, design professionals should comprehensively define client needs to align them with healthcare building designs [5,13,14]. However, conventional project definition practices have been proven to be inadequate since they lead to alignment problems between client needs and design solutions [11,13,15]. Actually, in a traditional framework,

users are rarely consulted during the design process [16]. This often results in an inefficient building in terms of the functionality and quality of the work environment [17].

To address this issue, participatory approaches, namely Lean-led Design, have been proposed [14,18]. Unlike the conventional mindset, this approach empowers the users during the project definition process in order to improve the usability and operability of the building to be designed [19]. Involving the users in the reflection is viewed as essential for a successful project [20].

The Lean-led Design approach has gained popularity in some countries such as the USA. It contributes to enhanced quality of healthcare and optimizes pathways that patients could follow [11,21]. However, research into the subject is limited [22]; as far as we know, no study has explored the impact of a similar approach on the design briefing.

This paper seeks to answer the following question: What are the intended advantages and challenges of a Lean-led Design approach? To answer that, a case study method was adopted [23]. The case study is a mega-hospital based in Quebec, where a Lean-led Design approach has been applied during the project definition phase. The objective was to achieve an alignment between client needs and the conceptual design, by engaging the main clients (users) in the process.

The paper is structured in eight sections. Sections 2 and 3 present the theoretical framing, comprising two strains of literature: the nature of the client and the need in healthcare projects, and the Lean approach in healthcare project. Sections 4 and 5 concentrate on justifying the methodological choices, as well as presenting the case study. Sections 6 and 7 present the research findings, followed by a discussion and conclusions in Sections 8 and 9, respectively.

2. The Nature of the Client and the Need in Healthcare Projects

Different terms are used synonymously with “needs,” even if they have subtle differences in meaning [24]. These include “purposes,” “desires,” “values,” “objectives,” and “wants” [25].

A “need” can be defined as “a measurable discrepancy between the current and desired status for an entity” [26] (p. 45). It could be related to quality, safety, functionality, aesthetics, economy, or time [27]. According to Bennett [28], a “need” is subjective and may be concealed because it may have social, cultural, political, or religious dimensions. This was corroborated by Thyssen et al. [29], who believe that a need is something that is perceived differently by each stakeholder and changes over time.

Needs are in the mind of the client, which makes the project definition process complex since not all clients can describe their needs to other parties [30]. This complexity increases in the case of healthcare projects, where the term “client” represents not only the owner but also a wide range of individuals whose needs evolve over time [31,32]. In healthcare projects, as explained previously, the client is the project manager, but there is also the legislator, the funder, the surrounding society, and the user. The term “user” consists of a wide range of individuals including doctors, nurses, administrators, patients and their families, maintenance technicians, cleaning staff, and, in the case of educational institutions, medical students [33].

To better manage this complexity, Bertelsen and Emmitt [34] classified needs based on client groups, namely owners, users, and society. Each client group has a specific need that changes based on their priority, role, or responsibility. For instance, the owner focus is on investment, while the user focus is on utility, and society mainly focuses on the aesthetics. For example, within groups of users, hospital administrators seek to reduce operating costs, nursing staff desire quick access to necessary equipment to provide care, and doctors focus on patient safety. Among medical specialists, what is perceived as a safety advantage might vary.

Another existing classification of needs is that of Altschuld and Witkin (2000, as cited in [24]) which is based on the three levels that generally exist in organizations. The first level (level 1) meets the needs of primary customers of the organization (the patients in our case), Level 2 meets the needs of the organization's staff that provide services to level 1 (e.g., medical professionals and service providers), and Level 3 meets the needs of the part of the organization that supports both levels 1 and 2 (e.g., a medical facility). However, according to Whelton [24], too often there is a loss of focus on levels 1 and 2 during the project definition process, which results in poor outcomes.

Furthermore, the complexity of need management in healthcare projects is not only due to the existence of various client stakeholders but also related to the dynamic nature of needs [35]. Needs tend to change between the project definition and the operation phases [36]. Technology-based medical treatments are growing rapidly, which means that hospital workspaces should adapt accordingly [37]. For instance, automation of drug distribution systems via robots represents a technological change that has emerged in health facilities; this constant evolution of technologies in hospitals requires not only adjustments in clinical practice, but also reconfigurations of workspace layout. Given that the completion of large-scale projects can sometimes take more than a decade, some degree of flexibility is required to adapt the process based on the dynamic needs for novel medical equipment, when plans are already approved.

Uncertainty of needs also depends on the demographic changes regarding patients. The population of North America is aging, which will mean an increased burden on the healthcare system [38]. The increase in population, along with the rise of certain diseases, means that specific sectors in the healthcare system need to expand their working areas, requiring redevelopment and thus a high level of workspace flexibility.

Therefore, needs do change over time, thereby increasing the difficulty of predicting them and defining the requirements of dynamic projects with long timescales and a high level of uncertainty. However, conventional practices do not take into consideration the dynamic nature of projects [39]. Capturing the needs is usually done in a hurry [1]. They are often established without participation from key client stakeholders [14]. Needs are mainly conceptualized by design professionals at a single point in time, based on interviews, examination of client documents, visits to similar facilities, and meetings with client representatives [40,41]. The focus is on technical issues (e.g., structural, mechanical), leaving out functional needs (e.g., internal traffic and relationship between hospital services) [16]. According to Blyth and Worthington [42], what usually seems to happen is that the only client involved in the process is the "sponsor" and "user" clients are usually not systematically involved by the team. The lack of involvement leads to the development of two user-need gaps that neither architects nor their clients are usually aware of: one being between designers and users and the other between users and paying clients. In fact, if design professionals do not properly understand user activities—and users are usually not involved in the project definition process [43,44]—it could be very hard, or even impossible, to propose a solution that is efficient enough.

To address these issues, the Lean-led Design approach was suggested as an optimal solution [18].

3. Lean Approach in Healthcare Projects

Lean is a management philosophy that was developed after World War II at the Toyota Motor Company [45]. Grunden and Hagood [18] (p. 6) define Lean as a structured way of continuously exposing and solving problems to eliminate waste in systems with the objective of delivering value to clients. Whilst Lean is a general management approach originating from the manufacturing world, it has been increasingly used in the healthcare sector in the past decades in order to redesign work processes, eliminate waste, and focus on patients.

The first Lean experimentations in hospitals included those from Seattle and Pittsburgh around the year 2000 [18]. The adoption of Lean principles in healthcare has increased rapidly until then, so much so that Lean healthcare has now become a major strand of research [46]. However, even though the Lean approach is proposed for healthcare projects, the objective is to improve and optimize the processes (e.g., emergency department, etc.) during the operation phase of the project life cycle [47], and not the project definition.

In fact, while the adoption of Lean principles in the healthcare operation stage is called Lean healthcare [47], the adoption of Lean principles in the project definition of a healthcare project is called Lean-led Design [18]. Other terms are also used to refer to this approach, such as Lean Design of hospitals (e.g., Hicks et al. [21]), Lean exploration loops into healthcare facility (e.g., Mazur et al. [48]), or Lean 3P design (e.g., Hicks et al. [10]).

This approach, specific to hospitals, has been defined as “a systematic approach to healthcare architectural design that focuses on developing, and integrating safe, efficient, waste-free operational processes in order to create the most supportive, patient-focused physical environment possible” Grunden and Hagood [18] (p. 18). This structured approach is proposed during the whole stage of project definition, starting by defining client needs in the preliminary design stage [18]. The objective is to improve the healthcare flow by rethinking the way hospital projects work [22]. Hicks et al. [21] emphasize the importance of analyzing and optimizing hospital flows—equipment, information, patients, staff, visitors, supplies, and medication—before estimating the required area of each department and proposing a design solution.

Lean-led Design represents a participative approach that empowers the user during the project definition process. Unlike the traditional approach, where the user is the passive recipient of a product, in Lean-led Design users take a more proactive stance during the whole process. Users also influence decisions on design options. This level of involvement represents the highest in the building design process, according to various authors (e.g., [14,49]). In fact, there are two other levels of user involvement, as explained by Caixeta et al. [14]: the informative level and consultative level. Each classification of levels is based on the reason and typology of interaction between users and architects [49]. The informative level is when users are not proactive. They only provide information about their needs and desires and receive information about the solution design from the professional design team. Consultative involvement occurs when users can give their opinion based on a set of predefined design options.

Therefore, involving users through participative approaches such as Lean-led Design should help designers to better understand user needs and align the designs of the building space with them, as well as to design an environment that contributes to the well-being of patients [18,50]. However, the use of a Lean approach to involve the main stakeholders for the definition of a major project—a new hospital—has not been investigated so far, to our knowledge. Publications on this subject are limited and, to the best of our knowledge, none of them have explored the challenges faced when implementing such an approach.

It is true that the Lean-led Design approach is not the only one that is patient-centered. Different approaches such as Evidence-Based Design (EBD) or patient-centered design have also been proposed to help designers in their decision making based on evidence and solid research findings, also in healthcare projects [51–53]. Both approaches have patients and/or clinicians at the center of reflections and aim to design the best physical environment for their well-being [54]. According to authors including Forgues et al. [11], Ding [54], and Peavey and Vander Wyst [55], improving the environment should positively impact the patients’ healing process and staff efficacy.

However, even though such initiatives have a positive impact on the project definition process by introducing the “voice of the client” or “voice of the patient,” they are supply chain solutions because the management process is under the control of the design team, with occasional or indirect client (user) involvement. Furthermore, the focus is more on

managing client requirements and improving design decisions and less on how to capture and understand functional and operational needs, unlike the Lean-led Design approach.

4. Research Method

To determine the expected advantages and critical challenges to applying a Lean-led Design approach, we adopted a qualitative case study method [23]. Unlike a quantitative approach that evaluates the study with numbers, qualitative research evaluates it with words and meanings [56]. According to Yin [57], a case study method allows researchers to retain the holistic and meaningful characteristics of real events, such as organizational and managerial processes. It aims to uncover deeper processes and understand how those processes unfold over time [58,59]. Yin [57] explains that the use of a case study strategy could be justified when the research question starts with “how,” “why,” or “what.” However, the only exception is that questions starting with “what” should not take the form of “how many” or “how much,” which is not the case here. In fact, our intent is not to understand how many factors impact the alignment but to understand which advantages and challenges are faced when implementing a Lean-led Design approach, which is a justifiable rationale for using such a research strategy.

In this project we used a single case study for three main reasons. The first is that a single case study does not mean a single experiment [57]. It can be an organization with multiple cases or also a single process with multiple temporal phases [60]. The second is that a single case study helps us to develop a deeper understanding of a subject, and thus helps to produce extra and better theories than a multiple case study [61,62]. It represents a significant contribution to theory building [57]. The third reason for choosing a single case study is that detailed qualitative accounts facilitate not only the exploration and description of the data in a real-life environment, but also the explanation of the real-life situations’ complexities, which would not be captured through experimental or survey research [63].

Furthermore, according to Yin [57], the selection of the case study should be based on different criteria. Stake [64] argues that the selection could be based on uniqueness. Eisenhardt [65] advocates choosing an “extreme” case study, so that the theoretical implications emerge more easily. Easton [66] agrees and adds that a “single case study must be able to stand on its own. The justification that is frequently used is the depth and comprehensiveness of case data. A case study will normally be very much more structurally complex and contains far more data at the level of the unit of analysis” (p. 8).

Therefore, based on these recommendations, the case study chosen was The New Hospital, located in Quebec, Canada, announced in 2013 and to be delivered in 2026 [67]. The main reason is that the project can be considered “unique” with regard to the particular context that characterizes it and in which strong opposing logics coexist. It represents, in fact, one of the first-ever single projects that implemented Lean-led Design approach in Canada during the early stages. It is also one of the biggest hospital projects in Canada, with an estimated cost of approximately 1,97 C\$. It aims to consolidate the clinical activities of two existing hospitals by involving a wide range of stakeholders through Lean-led Design activities in 2014–2015. Another rationale for choosing this case study is that it is a longitudinal case. This helps us to study the same case at different points in time; more specifically, it helps us to analyze over time the project definition process and practices. The last reason is the project’s proximity and accessibility: Quebec City.

In accordance with the guidelines for the case study approach [23], different data sources were exploited to study the New Hospital context: (1) archival data and (2) interviews.

4.1. Archival Data

We had full access to 10,380 documentations shared between stakeholders. In order to facilitate the analysis, we first developed different criteria to frame the corpus and choose only important documents for our research. For instance, an inclusion criterion is a document produced during the project definition, and an exclusion criterion is the press

communication. Based on the criteria selection, we were able to reduce the documents from 10,380 to 245. We included written project materials, presentations and videos on all Lean activities organized, floor plans, preliminary and final designs, and presentations used to share design solutions with clients.

4.2. Interviews

Interviews facilitate access to the present and the past (via memory). The aim is to explore the opinions, experiences, motivations, perceptions, and beliefs of individuals on a specific topic.

In this study, interviews were an important supplement and helped compensate for the limitations of other methods. They allowed us to cross-validate information gathered from documentation. According to Patton [68], they represent the best methods for a case study. Both allow for an open-ended response in the participants' own words, rather than closed questions. They offer sufficient flexibility while still covering the same areas of data collection.

Eighty-three interviews were conducted individually and in groups with the different participants in Lean-led Design activities. They were conducted between 2019 and 2020 with three clinicians, three patients, four members of clinical management, five project managers, two Lean agents, four architects, and two engineers. Due to the COVID-19 situation, it was challenging to arrange the meetings, especially with the clinicians. In addition, as the Lean-led Design activities were conducted between 2014 and 2015, the majority of the participants were not involved in the project anymore due to the dynamic context: there will be many personnel changes in total between the project's start in 2014 and its projected end in 2026. Furthermore, although the number of interviews seems not to be statistically significant, the people interviewed are meant to be representative of all participants in the project definition process.

The interviews lasted between 30 and 120 min. For each respondent, we prepared a semistructured interview guide in order to understand the different perspectives. They included information about the interviewee's experience with Lean methods, problems faced, and results achieved. The questions developed for the semistructured interviews were open-ended. The objective was to provide the interviewees with more flexibility [69]. Table 1 lists the questions used when interviewing participants in Lean-led Design activities. The questions were not limited to the abovementioned, and were adapted to the person being interviewed. Supplementary questions were asked to elicit additional information so as to better understand the context.

All the interviews were recorded with the agreement of all interviewees. The participants' identities and information were treated confidentially. Ethical clearance of this study was provided by the Ecole de technologie supérieure Ethics Committee (reference number H20181105).

Furthermore, to help us with the coding process, we used NVivo 11 software to reveal the main themes in the respondents' testimonies about the advantages and challenges faced during the project definition when implementing Lean-led Design.

The data analysis was inspired by grounded theory and followed different levels of coding [70]. The first level means that we coded everything that seemed relevant to us according to our research question. At this stage, we had a lot of codes without any linking structure. The second level was analyzing the initial codes in order to highlight the key themes that emerged from participants' testimonies. These codes could integrate several codes of the first level or could be new codes. After that, in the third level we formed links between the codes of second levels in order to highlight the main challenges and advantages of implementing Lean-led Design.

Table 1. Interview questions (managers, Lean facilitator).

Category	Questions
General information	What was your role/function in this project? - What is the composition of the team? - Is it multidisciplinary? What are the profiles of the team members? (Engineers, architects, clinical managers)? Which of the following workshops (also called as kaizen) activities have you participated in (kaizen 1,2a, 2b, 3, 4, 5)? Have you received kaizen training before? - If yes: By whom? When? What was your role (observer, facilitator, etc.)?
General methodology	How many people participate in the organization and preparation of kaizen? Who are they (profiles)? When you decide to do kaizen, how far in advance do you need to send invitations? During the project definition process, with which actors do you interact? At the end of one project, do you collect the participants' feedback (about the participation approach)? • If yes: How (e.g., a satisfaction survey)? What do you do with this feedback? How would you summarize the most frequent comments/questions? Is it possible to get access to it? • If no: Do you think it could be useful? Do you think we could meet one participant to get his/her feedback?
Advantages and challenges	Are there any advantages to implementing a participative approach? - If yes, what are the main advantages of this participative approach? Are there any challenges faced when implementing a participative approach? - If yes, what is the most difficult step when implementing a participative approach? (What is more constraining?) What would be your advice for a beginner starting out with a participative approach? What are the pitfalls to avoid?

A validation meeting with the research team helped us to change and modify unclear aspects and, thus, improve the accuracy of the case study data [71]. Critics typically state that a single case study offers a poor basis for generalizing. However, according to [57], such critics are implicitly contrasting the situation to quantitative research. In fact, unlike quantitative surveys that aim at statistical generation, case studies aim for analytical generalizations. In analytical generalization, the researcher is striving to generalize a particular set of results to some broader theory.

5. Overview of Lean-Led Design Activities Implemented in the New Hospital

The New Hospital is the result of merging two out of five hospitals of CHU de Québec-Université Laval. The complexity of this project is not only due to the need for the construction of new buildings (180,693 m²) and the renovation of parts of existing buildings (27,492 m²), but also maintaining the regular operations of the two already functioning hospitals [67].

For the purpose of better collaboration and communication, more than 220 people were co-located near the project site. It is true that a project office is a common feature of a major project; however, the particularity of this project required the addition of clinical managers (who represented the voice of the users) to the management's organizational structure:

“Our clinical management is formed by architects and engineers, even the project manager is with us. We're a strong trio. Without the project office, it would have

been much more difficult” [member of the New Hospital clinical management team].

Furthermore, to deal with the complexity of aligning the care services of the two hospitals consolidated, the Lean-led Design approach appeared as one of the best solutions [72]. The use of this approach by the clinical management of the New Hospital aimed at creating hospital services around patients’ needs.

A Lean-led Design approach was applied through five workshops called “*kaizen*,” between planning and programming stages (May 2014 to November 2015):

- Kaizen 1 (Building a patient-centered hospital): The objective was to define a common principle along with a common vision of the future hospital.
- Kaizen 2 (Building a patient-centered hospital): The objective was to comprehend the reality and workflow of the two merged hospitals and identify existing problems.
- Kaizen 3 (Combining strengths): The objective was to define the location of the hospital sectors while thinking about workflow effectiveness.
- Kaizen 4 (Imagining the future hospital together): The objective was to illustrate different possibilities of positioning hospital sectors on the site and to keep the best implementation hypothesis.
- Kaizen 5 (Defining and validating our operating modes): The objective was to transform practices while thinking about this new organization and how to prepare for the transition.

Each kaizen lasted between two and four days and involved different stakeholders including users (patients and clinicians), project managers, clinical managers, and construction professionals (architects and engineers). The objective of the first Lean activity was to create a common vision of the new hospital. The objective of the second one was to analyze for each hospital the seven hospital flows (patients, staff, families and friends, equipment, medication, information, and consumables). This analysis helped us to optimize the flow of the new hospital and explore the proximity links between different sectors during Kaizen 3. Based on that, the architects mandated a programming stage and started to be involved and lead the process, developing various hypotheses for hospital services implantation on the site. These hypotheses were later evaluated by the users during Kaizen 4 in order to retain the one that was best fit for purpose. The last kaizen had as its objective exploring the operating modes of the different hospital sectors. At the end of these five kaizen, a Functional and Technical Program (FTP) was developed specifying all the clinical and technical needs and requirements of the project. Afterwards, the government approved the project so that it could go forward to the design phase with the elaboration of the plans and specifications. To do this, a new team of professionals (architects and engineers) was appointed. However, unlike the planning and programming stages, the design stage was realized following a nonparticipative approach due to a lack of time and resources.

In the following sections, we present the main points related to our research question that were addressed by participants during the interviews and emerged from the documents reviewed.

6. Expected Advantages of Lean-Led Design

This section presents the main expected advantages of implementing Lean-led Design: (1) commitment, (2) sharing of a common vision, (3) mutual trust, (4) innovative solutions, and (5) alignment between needs and the design solution.

6.1. Commitment

In the context of the current research, commitment is meant to refer to both user and client commitment. It was noticed that, when a Lean-led Design was implemented, users gradually developed a sense of ownership and commitment, as quoted by this respondent:

“The vision exercise ensures that the project changes from ‘their project’ to ‘our project’. It helps to develop a feeling of belonging and commitment” [clinician].

Participants develop a new collective identity through the course of the kaizen activities, starting from a sectoral vision and progressively moving towards a unified vision, “us.” The concept of evolution was cited by several participants during these activities. At first, participants referred to their respective hospital, but gradually developed a collective identity; an “us” for the new hospital. This happened after combining the strengths of both hospitals and helping the users to gradually create their new hospital. As time went by, the overall synergy of stakeholders was enhanced, since each had a better comprehension of the reality of others. It is noteworthy that at the beginning of the planning stage, all users were rewarded for their participation in kaizen. However, starting with Kaizen 3, many of them participated as volunteers without any monetary compensation.

In conclusion, it is possible to say that inclusive approaches such as Lean-led Design promote users’ sense of belonging, commitment, and satisfaction by involving them in the early stages of project definition. However, this could also lead to stakeholder disappointment if their expectations are not met or they are no longer involved.

6.2. *Sharing a Common Vision*

Another point that was raised is the sharing of a common vision between different stakeholders. This represents one of the primary concerns of the New Hospital clinical managers since the first kaizen, organized in 2014:

“Lean activities enabled us to communicate between doctors and understand each other’s needs. The purpose is to help us achieve a common vision of the actual and future hospital services” [clinician].

“The secret of our success is really a common vocabulary and our common vision. We made a lexicon, for instance: what is a kitchenette or a rest room for: (1) the patient, (2) the care unit?” [member of the clinical management team].

Both the users and the members of the clinical management team expressed that the Lean activities helped them reach a meaningful consensus about the project’s objectives and decisions. Working together, the participants tried to share their views about the project and make sure that they were well understood by others. This gradually led to the development of a shared understanding and mental alignment among them and thus motivated the users to be more committed to the project. However, it is noteworthy that this factor was only identified during the planning and programming stages when a participative approach was implemented. This resulted in, according to the clinical managers, a loss of the previously reached consensus. This means that, more important than sharing a vision, is its continuity throughout the whole process of project definition. However, it is challenging to achieve this when the context is dynamic, with changes in personnel.

6.3. *Mutual Trust*

In the New Hospital project, the interviewees’ answers regarding trust were somewhat contradictory since both factors were identified.

According to project managers, trust was created between participants during the Lean-led Design activities: “The kaizen has helped to strengthen mutual trust between users and professionals” [Project manager].

Project managers believed that during different kaizen sessions, a trustful environment was created, which enhanced user commitment and helped solve any conflicts between participants. By contrast, designers had another point of view: “clinicians don’t have complete confidence in our work” [Professional designer]. According to them, users did not completely trust designer decisions and choices in spite of their involvement in the process of project definition through Lean activities.

This lack of trust could be explained by the complexity of building a trustworthy relationship during a dynamic and complex project involving heterogeneous groups with different experiences, domains, and languages.

To conclude this matter, although the implementation of a participatory approach such as Lean-led Design should have facilitated the development of mutual trust, it is not possible to assume that it was completely achieved during the planning and programming stages, and especially during the design stage, during which a nonparticipative approach was implemented.

6.4. Innovative Solutions

From the start, the whole Lean approach was seen by the clinical management team as innovative, and activities were planned in order to elicit the most innovative solutions possible. The Lean activities were conceived so that participants had room to innovate and explore all the Lean concepts of operation so that the overall goals of reducing travel distances for patients, reducing waiting time, and improving the operating modes. Of course, participants had to deal with the reality of constraints, but they mentioned the possibilities of translating their clinical care through the definition of the new physical organization. Having time to discuss and getting deeper in the subject also favored emerging innovations, as explained by one respondent:

“From the fourth, fifth and sixth implantation hypothesis, we saw more and more innovations, things we did not even expect to have thought about.” [clinician].

Thus, innovation seems to have been stimulated by this level of collective action, through stakeholder involvement and commitment to the initial vision for the new hospital. The Lean approach taken by the hospital, described through participants’ testimonies, has brought out important goals, collaborative ways of getting the work done with innovative solutions, and an increased commitment to and sense of ownership of the project.

6.5. Alignment between Needs and Design Solution

Different respondents agreed that user involvement in decision-making is an important factor to facilitate the alignment of client needs and design solutions:

“The Lean approach helped us to better align our needs” [patient].

A clinician explains that Lean-led Design approach gives the user more power during the process, which helps them to make better decisions:

“During the kaizen exercises we were more than observers. We thought about and made some important decisions about the new hospital. For example, we took decisions based on the proximity links between the different services specific to each specialty” [clinician].

The participation of users in decision making has a significant influence on the design solution since they understand the functional issues better than the design professionals. This gives them more power during these stages and could explain their lack of involvement in the decision-making process during the design stage. At this stage, the process is more technical, and the majority of users lack the knowledge to participate in decision-making along with designers. Users are thus unable to exert representative power.

User participation in the project definition process is, itself, indicative of an influence over the decision-making process. This brings added value to the process, and also helps to achieve an alignment between needs and solutions.

7. Challenges Faced

This section presents the main challenges faced during the project definition when implementing a Lean-led Design approach: (1) lack of resources and time, (2) lack of know-how, (3) changes in personnel and/or users, (4) dominating actors.

7.1. Lack of Resources and Time

A lack of resources (human and budgetary) and time is one of the well-known challenges when implementing a participatory approach like Lean-led Design. In the New Hospital project, while sufficient resources and time were allocated to implement Lean activities during the planning and programming, a lack of resources was identified during the preliminary design stage:

“Project managers want to get results, but they have a tight budget. It is not possible” [Mechanical engineer].

This explains the lack of implementation of a participative approach during this stage.

In addition, due to the limited budget, some requests made by users were not considered during the design stage:

“The budget is a very important element that helps or limits the fit between what is expressed and what is achievable” [project manager].

Considering all needs may lead to being over budget. However, users who participated in Lean activities were not aware of these limitations:

“We make them dream too much . . . as if there is no constraint” [member of the clinical management team].

This created a gap between the needs defined by the clinicians during the kaizen and those presented in the design solution. Furthermore, due to a lack of time and resources, especially at the end of the programming stage, the technical part of the FTP was completed in a hurry. As highlighted by one respondent:

“Because the process was so long. We therefore had less time for the next phase” [architect].

The design professionals had less time to develop the technical requirements, since the focus was on the functional requirements. This led to errors and extra work. Thus, resources and time can positively or negatively influence the project definition process. For instance, having resources and time facilitates innovation and the implementation of new methods (e.g., participative methods), whereas a lack of resources and time limits them.

7.2. Lack of “Know-How”

We mean by the lack of “know-how” a lack of knowledge about how to implement a method or manage a process. This point was identified mainly during the programming stage, especially when design professionals started to be involved in the process:

“There were designers who had to do Lean but didn’t know how to do it either” [clinical manager].

These professionals were responsible for organizing Kaizens 3 and 4. However, they did not have experience implementing such activities. In order to reduce the impact of this factor, Lean agents were contracted to support them during the organization and the animation of the different kaizen.

A lack of know-how was also identified at the end of the programming (when drafting the FTP). In the words of a clinical manager, “This is a fairly classic problem because our professional firms in Quebec are very bad at writing FTP. Editors don’t know how to do it.”

In fact, the responsibility for FTP drafting was given to junior architects, who had less practice and experience with the hospital project and did not participate in the kaizen. This led to errors and gaps between users’ needs and the translation of these needs into an FTP document. Thus, achieving alignment requires more than just enough staff, but also sufficient experience and competencies.

7.3. Changes in Personnel and/or Users

Changes in personnel and/or users during and between the project definition stages were raised by design professionals and clinical and project managers as one of the principal challenges of implementing a participative approach.

According to the clinical managers, changes in the design professionals that occurred mainly between the programming and conceptual design stages have negative consequences on the consistency of leadership and the translation process (from the needs into the design solution). One of the clinical managers phrased this as follows:

“the -baby-designer who has not experienced lean activities with us, will distort what we did when he will draw” [member of the clinical management team].

As explained in Section 5, at the end of the programming stage, a call for tender was initiated to select a new team of professionals for the design stage: architects, electrical and mechanical, and structural engineers. However, even though some of these professionals participated in the Lean activity, according to the clinical managers, a change in them may distort the architectural concept and lead to multiple rework iterations.

The change in users over the project were also highlighted by one of the interviewees:

“There are users who change, others who retire. It’s a big challenge, especially if we want to maintain a common vision” [project manager].

Between the time that the FTP was drafted and the beginning of the conceptual design stage, a large number of clinicians changed jobs. As an example, the manager of the nephrology department changed three times during this process. Because of that, several contradictions have been identified:

“There were several contradictions because of the clinicians newly involved did not have the same needs as the clinicians who participated in the kaizens” [architect hired for both programming and design stages].

The clinicians who identified the needs and designed the project at the beginning are thus not the same clinicians consulted during the conceptual and design stages. In the New Hospital project, the design professionals became confused over what was decided during the kaizen and the needs of the new clinicians.

Furthermore, changes in personnel and/or users between the programming and schematic design stages mean that factors such as commitment, previously addressed, will be impacted. The professionals and users have to start again and build up a new trustful and committed environment. However, this will be difficult if the approach chosen is not participative.

7.4. Dominating Actors

“Dominating actors” refers to stakeholders who have significant power in the process, especially when making decisions. This was identified as a challenge that could be faced during project definition. In fact, while the Lean-led Design approach empowers users during the planning and programming stages, architects dominate the process during the design stages since a nonparticipative approach is adopted.

In the New Hospital project, the designers responsible for the design stage used the power provided by their ownership of the design knowledge to take control of the process. They did not acknowledge the work already accomplished by the Lean activities’ participants during the first two stages of project definition, which represents an important output of the design solution:

“But every time the architects design new things, without considering the work we realized during the previous kaizen” [clinical manager].

An example of that is that the architects hired for the design stage modified some decisions concerning the dimensions of the hospital rooms previously made by consensus during the kaizen. This led to dissatisfaction from some members of the clinical management team.

We now turn to discussing those findings in light of the relevant literature.

8. Discussion

The results presented above highlight different advantages and challenges to implementing a participative approach, namely Lean-led Design (Table 2).

Table 2. The main advantages and challenges identified.

Advantages	Challenges
Commitment	Lack of resources and time
Sharing of a common vision	Lack of “know-how”
Mutual trust	Changes in personnel and/or users
Innovative solutions	Dominating actors
Alignment between needs and design solution	

The first advantage of involving users, according to the interviewees, is commitment. In line with these results, Mazur and Johnson [48] highlight that the commitment to values, goals, and vision is important to achieve alignment between clients and construction professionals.

The second advantage is that Lean activities help participants to share a common vision about the needs and the project goals. Bingham et al. [73] state that sharing a common vision helps align project team members’ attitudes by reducing conflict between them and promoting acceptance rather than compliance. In fact, users’ involvement not only helps architects to create a shared vision among participants, leading to the creation of a commitment and a collective understanding of a desired future hospital, but also leads to a better understanding and definition of the functional needs [22]. Given that users are “experts on their own experiences” [74] (p. 2), involving users during the early stages helps to raise architects’ knowledge about how hospital activities are performed and how services interact. This information is critical to reducing design mistakes in future buildings and, consequently, improves patient safety by ensuring the high-quality performance of the services [75].

The third advantage of a Lean-led Design approach is mutual trust between users and design professionals. The Construction Industry Institute [76] and Ibrahim et al. [77] explain that trust between team members is built once a good relationship is established; therefore, it represents a long-term process [78]. According to Scherer [79], the challenge is to build a trustworthy relationship in a complex project where stakeholders do not know each other or do not have necessary expertise in each other’s domains. For that purpose, Grunden and Hagood [18] proposed promoting trust between participants by using a series of games during the kaizen, such as a simple wooden blocks game.

Another advantage identified in this research is the innovative solutions that could be generated by motivating the participants to provide their ideas and be creative. In the context of project management, Griffith and Gibson [80] propose that the motivation of team members to successfully perform their job could be realized through nonmonetary and monetary compensation.

The last advantage raised by the participants is the alignment between needs and design solutions. However, despite the fact that the interviewees as well as various authors, such as Eriksson [81] Grunden and Hagood [18], and Chbaly and Brunet [72], emphasized the importance of applying a participatory approach, based on the research findings, we could not demonstrate that its implementation automatically ensures an alignment between user needs and building services. In fact, until the drafting of this report, none of the New Hospital buildings were operational. The project is still between the design and construction stages. This means that we cannot evaluate whether, according to users, the buildings are fit for purpose.

Furthermore, the implication of critical actors in the project definition process is beneficial, and their contribution through a structured Lean approach could facilitate both change management and the quality of the project. However, insufficient funding and time to realize the project and control different aspects of the project definition represent one of the well-known challenges. In fact, both the literature (e.g., Hicks et al. [21], Whelton and Ballard [82]) and the case study findings showed that the investments required for undertaking such an approach are not to be minimized; these include the structure to be put in place, a dedicated team, and physical and material resources, along with compensatory measures for attracting participants to the kaizen. There might be a tight schedule and budget to work with, yet the results show that important advantages can be obtained, such as reduced risks and modifications in the project, better teamwork between critical stakeholders (clinical and administrative staff), etc. In the case of the New Hospital project, these advantages will be evaluated once the project is finished, but preliminary findings highlight that the initial investments are already paying off.

In addition, implementing a participatory approach demands from architects more efforts in coordination than conventional practices do [83]. The quality of the design solution proposed depends not only on their design skills but also on other knowledge. The architects engaged need not only knowledge and more ability skill in their own field to organize and conduct Lean activities, but also knowledge about other disciplines, such as engineering, sociology, psychology, etc. [84].

Another challenge when adopting a Lean-led Design approach is the reduction of architects' control over the process of project definition, since users are co-designers [50]. They lead the design briefing process along with the architects, which provides them with additional control and ownership of the process [1]. Therefore, a Lean-led Design approach is, itself, indicative of user power and influence over the decision-making process, as highlighted by Tzortzopoulos et al. [13] and Caixeta et al. [85]. It is a user-driven management scheme that changes the power balance between architects and users. During Lean activities, the patients and their experience are not only at the center of the reflections but also part of the process.

9. Conclusions

The findings presented in this paper are part of a larger research project aiming to acquire further insight into healthcare project definition. This paper adds to our knowledge about the advantages of, as well as the challenges that could be faced by managers and architects when, implementing such a participative approach. In fact, five advantages and four challenges were identified.

On the basis of the above findings, it becomes possible to suggest that such a participatory approach can facilitate, among other things, commitment, the sharing of a common vision, and understanding between users and architects, thus meeting user needs. This can decrease waste and generate more value for the end users. However, implementing such an approach require resources, time, and knowledge.

An important limitation of the study is related to the single case study chosen. However, it is a unique and a complex case, which helped us to realize a longitudinal investigation (between project definition stages). Future research could verify whether the advantages and challenges identified in this study are present in other healthcare projects

and/or whether other advantages and challenges will emerge in other contexts. We plan on continuing the research by developing a framework for measuring the degree of alignment between needs and design solutions when implementing participatory approaches in complex projects.

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