

A Lean-Led Design Approach

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Lean-led Design is a user-empowering approach that gained popularity in some countries such as the USA. It is proposed to be used during the project definition of healthcare projects in order to enhance quality of healthcare and optimize pathways that patients could follow.

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1. Lean Approach in Healthcare Projects

Lean is a management philosophy that was originally formulated after World War II by the Toyota Motor Company ^[1]. Grunden and Hagood ^[2] (p. 6) frame Lean as a structured way of continuously exposing and solving problems to eliminate waste in systems, with the goal of delivering value to customers. While Lean is a general management approach that came out of the manufacturing world, it has been used extensively in healthcare in recent decades to help redefine work flows, reduce waste and shift the focus to patients.

The first experiments with Lean in hospitals occurred in Seattle and Pittsburgh around the year 2000 ^[2]. The adoption of Lean principles in healthcare has grown rapidly since then, to the extent that Lean healthcare has become a major area of research ^[3]. Nevertheless, even though the Lean approach is being proposed for healthcare projects, the goal is to improve and to optimize processes (for example, emergency department and so on.) during the operation phase of the project life cycle ^[4], rather than during the project definition where clients needs are identified and design solutions are conceptualized.

In fact, while the adoption of Lean principles in the healthcare operation stage is called Lean healthcare ^[4], the adoption of Lean principles in the project definition of a healthcare project is called Lean-led Design ^[2]. Other terms are also used to refer to this approach, such as Lean Design of hospitals (for example, Hicks et al. ^[5]), Lean exploration loops into healthcare facility (for example, Mazur et al.), or Lean 3P design (for example, Hicks et al. ^[6]).

This approach, which is specific to hospitals, was defined as "a systematic approach to healthcare architectural design that focuses on the development and integration of safe, efficient, and waste-free business processes to create the most supportive patient-centered physical environment possible" Grunden and Hagood ^[2] (p. 18). This structured approach is proposed along the entire project definition, starting with the definition of the client's needs during the preliminary design phase ^[7]. The goal is to enhance the flow of healthcare by rethinking how hospital projects work ^[8]. In other words, it aims at analyzing and optimizing hospital flows - equipment, information, patients, staff, visitors, supplies, and medications - before estimating the space needed for each department and proposing a design solution ^[5].

Lean-led Design is a participatory approach that empowers the user during the project definition process. Contrary to the traditional approach, where users are merely passive receivers of a product, in Lean-led Design, users take a more proactive stance throughout the process. Users also influence decisions about design options. This level of involvement is the highest in the building design process, according to (for example, ^{[9][10]}). In fact, there are two other levels of user involvement, as explained by Caixeta et al. ^[9]: the informative level and the consultative level. Each level classification is based on the typology of the interaction between users and architects ^[6]. The informative level is where users are not proactive. They only provide information about their needs and wants and receive information about the solution design from the professional design team. Consultative participation is when users can provide input based on a set of predefined design options.

Therefore, involving users through participatory approaches such as Lean-led design is expected to help designers to better understand user needs and align the design of the building space with those needs, as well as design an environment that contributes to patient well-being ^{[2][11]}. However, the use of a Lean approach to involve clients (including users) in the definition of a major project has not been studied so far, to the knowledge.

Admittedly, the lean-led design approach is not the only one that is focused on the patient. Various approaches like Evidence-Based Design (EBD) or patient-centered design have also been proposed to help designers in their evidence-based decision making and sound research results also in healthcare projects ^{[12][13][14]}. Both of these approaches place patients and/or clinicians at the heart of the considerations and seek to design the best physical environment for their well-being ^[15]. According to Forgues et al ^[16], Ding ^[15], and Peavey and Vander Wyst ^[17], improving the environment should have a positive impact on the healing process of patients and the efficiency of staff.

However, even though these 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 involvement of the customer (user). In addition, the emphasis is placed more on managing customer requirements and improving design decision-making and less on addressing and understanding functional and operational needs, unlike the lean design approach.

2. 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 ^[18].

For 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 ^[19]. 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 goal was to establish a common principle and a common vision for the future hospital.
- Kaizen 2 (Building a patient-centered hospital): The objective was to gain an understanding of the reality and workflow of the two merged hospitals and to identify existing problems.
- Kaizen 3 (Combining strengths): The objective was to determine the location of the hospital sectors while thinking about the efficiency of the work flow.
- Kaizen 4 (Imagining the future hospital together): The objective was to illustrate different positioning possibilities for the hospital sectors on the site and to select the best location hypothesis.
- Kaizen 5 (Defining and validating the operating modes): The objective was to transform practices while reflecting on this new organization and how to prepare 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 for the new hospital. The objective of the second activity was to analyze for each hospital the seven hospital flows (patients, staff, families and friends, equipment, drugs, information and consumables). It was allowed to optimize the flows of the new hospital and to explore the proximity links between the different sectors during Kaizen 3. On this basis, the architects mandated a programming stage and started to get involved and lead the process, developing various hypotheses for the implantation of hospital services on the site. These hypotheses were then evaluated by the users during Kaizen 4 in order to select the most suitable one. The last kaizen

aimed to explore the operating modes of the different hospital sectors. At the end of these five kaizens, a Functional and Technical Program (FTP) was developed, specifying all the clinical and technical needs and requirements of the project. The government then approved the project so that it could move into the design phase with the development of plans and specifications. For this, a new team of professionals (architects and engineers) was appointed. However, unlike the planning and programming stages, the design stage was carried out using a non-participatory approach due to a lack of time and resources.

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