HOW TO NAVIGATE THE DILEMMA OF VALUE DELIVERY: A VALUE IDENTIFICATION GAME

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ABSTRACT

Delivering value on projects is one of the fundamental concepts in lean construction through the Transformation-Flow-Value (TFV) theory. The concepts of transformation and flow are thoroughly explained through the lean construction literature, and various educational games are offered to support the understanding of the flow concept including work-flow variability, takt time, waste elimination, pull systems, and efficient planning. The concept of value, however, tends to be more complicated where researchers are continuously trying to better understand value delivery on construction projects. The International Group for Lean Construction conference offered research on Target Value Design as well as games to reap knowledge about project value. This paper provides additional support to understand the value concept and its characteristics through a proposed educational simulation game. The game demonstrates how designers identify requirements on projects, how various parties value different things, and how to potentially deal with conflicting requirements. The game helps students and lean practitioners in understanding the process of eliciting perceived value on a project and achieving shared understanding through proper communication between different parties. This would help in managing projects in a way that delivers higher value for the different stakeholders, thus achieving successful projects with higher satisfaction rates.

KEYWORDS

Value and design management, serious games simulations, collaboration, benefits realization.

INTRODUCTION

The early definition of value in construction has focused on understanding and achieving client's needs or client's objectives (Bertelsen & Emmitt, 2005). However, different stakeholders on a project have their own interests and needs, thus formulating a different value perception (Haddadi et al., 2016). Accordingly, research had looked into separating the value of interests into external and internal value (Emmitt et al., 2005). External value represents the client value, and internal value is defined by and between the design and delivery team (Emmitt et al., 2005). Additionally, the client in this case represents different stakeholders including the users of the building, the owner, and investors. Not to forget, the surrounding neighbourhood and community needs are part of the client's complex system. Given this complexity, it is difficult to conceptualize and define value. User's and owner's value must be aligned and the design team shall need effective processes to create value on projects (Haddadi et al., 2016).

Moreover, value on projects has distinct characteristics being dynamic or changing over time, subjective, and stakeholder specific (Christoffersen, 2003). Regarding the latter, conflicting requirements among stakeholders on projects is a major issue when delivering value.

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Drevland et al. (2017) discussed ethical dilemmas when delivering value on projects, where they questioned whose value to prioritize "the good of the client versus the good of wider society" or "the good of the developer versus the good of the buyer". Thus, this adds up to value complexity and confusion. Accordingly, research is still investigating ways to simplify the concept and propose methods and tools to understand how to deliver value on projects.

The problem amplifies when talking about novice lean practitioners and designers. They usually do not have a clear idea about the concept of delivering value on projects nor the complexity of the design process, specifically the early ideation phase. In an attempt to help resolve this issue, and to provide a clearer picture of the value concept, this research adopted the active learning path by proposing a value identification educational game. Target Value Design (TVD) games have been proven to be effective in learning important principles relating to TVD and improving overall value while considering a target cost (Jacob et al., 2021). Such games has been proven to act as useful pedagogical techniques to teach challenging concepts in lean construction while increasing students' enthusiasm (Hamzeh et al., 2017). A growing use of these games have been identified using a systematic review conducted by Bhatnagar et al. (2022) proving their effectiveness. In this study, 96 lean games were identified and only one game relates to value capture and value management (beyond TVD games) and this game was categorized as slightly discussed. While the concept of value is still considered vague, this suggests that there is a need for such research to help in better understanding value and consequently delivering it and achieving higher satisfaction on projects. This paper contributes to the growing field of using simulation games as tools for learning lean concepts by specifically focusing on the value identification component. Achieving a better understanding of the ambiguities inherent in our concepts of project value can provide an opportunity for achieving higher value.

THE VALUE CONCEPT

VALUE DISCUSSIONS IN THE LEAN COMMUNITY

The international lean community has been involved in research about value delivery since the inception of the lean construction group. From the early start of lean philosophy, Koskela (1996) admitted that practitioners do not really understand how value is generated during a project and called for challenging theoretical research. Customers have expectations and requirements, and designers or suppliers would need to provide value through their product or services. Yet Koskela (1996) described the internal mechanism of this two-way connection as a black box. Ballard & Howell (1998) explained how thinking about value alters the traditional conversion model in design which requests the customer to clearly present their complete or fixed design brief. Contrary to that, designers need to elicit customer's desires, explain their consequences, and negotiate customer's ends and means (Ballard & Howell, 1998). Additionally, Leinonen & Huovila (2000) in their paper *the House of the Rising Value,* they indicated the difficulty, yet the importance, of creating value. They suggested in their study a tool that provides realization of project performance based on project definition. It can be combined with quality function deployment tool which helps creates requirements from needs. The paper highlighted that methods to enhance value creation are available but still not fully exploited and difficult to deal with.

Since then, researchers invested time and efforts to assist the construction industry in general and the lean community specifically with finding answers and improving knowledge about the value concept and associated methods.

In fact, from the repository of the IGLC conference, for the years between 1996 and 2021, more than forty papers are categorized under the *value generation* topic providing insights and research evolution on the value topic. Salvatierra-Garrido et al. (2012) performed a literature

review to explore the value concept within the IGLC conference proceedings from years 1993 till 2011. They spotted that the value concept is still ambiguous due to the various interpretations of its meaning and due to its subjective nature. Also, the research noticed the focus on delivering value at the project construction level by reducing waste and praised the efforts to fulfil customer's requirements.

In general, going through a good deal of the lean construction literature, the following approaches were offered as basis for identifying and improving value on projects:

- Collaboration as basis for project delivery: collaborative decision-making, early involvement of downstream players in design, intensified planning, and open communication to produce a clear brief.
- Cross-disciplinary coordination and intensified design with multiple professionals.
- Co-location; productive work environment: specifying the right pace, meeting frequency, meeting agendas, interactive design sessions, big room with right people, freely share concepts and ideas.
- Bring problems to surface, have candid conversations, and proactively change course of action.
- Carefully selecting teams: based on mindset and alignments, based on prequalification.

The proposed value identification game focuses on the first point and intends to provide assistant with producing the value proposition list (also called the value attributes list).

WHY LEARNING ABOUT PROJECT VALUE IS IMPORTANT

Researchers and practitioners have expressed interest in learning about the concept of delivering value on projects as indicated above. The lean community had offered a specific category in the international group of lean construction conference named *Value generation*, which reflects the importance of investigating the topic beyond making it merely about project construction processes and minimizing waste. The briefing process still suffers from unstructured methods (Leinonen & Huovila, 2000), therefore learning about value identification would help in structuring the briefing exercise more. Moreover, during the lean course, as soon as the educator reaches sessions about early design phases and the wicked design process, confusion is noticed. The silent squares game helps students learn about the importance of collaboration to minimize rework in design. Yet, focusing on the value identification is still needed.

In the business world, a value proposition canvas had been introduced to produce products that meet customers' needs by understanding their problems. Construction projects are no different. Architecture and engineering professionals need to produce projects that meet different stakeholder's needs including those of the customers, end-users, and communities (Pirozzi, 2019). Learning about the value concepts and how to identify value from the early beginning will help practitioners in minimizing iterations in design. Nonetheless, designers need to keep their options open. This is called Set-based design in lean, and part of it is related to delivering higher value by keeping flexibility and not locking design early during the project design (Ballard, 2000). We are trying to focus on the fact that design is not a onetime *shot*, design evolves as needs also evolve with the progression of the project. Design thinking is a problem-solving approach used to create design solutions that focus on user's needs. It involves several steps to reach a satisfactory design solution including: empathy, ideation to generate a wide range of ideas by brainstorming, defining, prototyping, divergence and convergence, then testing to refine the solution based on feedback (Efeoglu et al., 2013). Identifying value relates to the first two steps of the design thinking approach.

Moreover, learning about project value will help in understanding that hidden needs exist. Wandahl (2004) explained the four windows for requirements and needs on projects (Figure 1). The first includes what is known for both the client and the design/delivery team. The second is what is not known to the client but know to the team. The team in this case helps the client

by asking questions and making requirements clear. The third window includes what is known to the client but not known to the team. Here, the client should inform the team about their desires and expectation by simply telling them. The hardest part is window four where requirements are unknown for both the client and the team. It takes a lot of collaboration on projects through workshops, questions, researching, and transparent engagement to try to reveal those hidden needs.
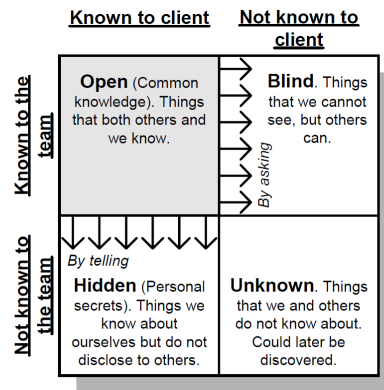

Figure 1. Johari Window retrieved from (Wandahl, 2004).

THE VALUE IDENTIFICATION GAME

GAME DEVELOPMENT AND LEARNING OBJECTIVES

The authors developed the value identification game or Value ID game to help novice designers and project managers in understanding the concept and the process of identifying value on construction projects. This preliminary step of identifying value would help in subsequently delivering higher value during the project phases. One of the authors has been teaching lean construction for more than ten years now and the value topic always raised curiosity among students. The idea of developing this game was thus inspired in the classroom. Yet, the actual development of the game was when the authors got involved in the design of a housing project and sensed the confusion among practitioners as well regarding dealing with requirements and value identification. The game was then developed and tested in a class setting a few times and then presented in front of lean experts to get feedback. The adjustments in the game based on feedback are specified in the relevant sections herein.

Thus, questions about project ideation and value definition were raised; How to identify owner's needs? Users' needs? Community's social needs? Environmental needs? How to make these needs work in conjunction with each other? How to deal with conflicting requirements? And how to really understand what is behind the client's requirements? The design production is related to storytelling, designers need to elicit the needs of different parties, research the different alternatives and options, and then innovate to uniquely produce the preferred design. In response to these inquires and to understand the general idea of value identification, the authors proposed this game to facilitate drawing connections to the importance of understanding value and having a clear vision from the beginning. Specifically, the authors highlight the three main learning objectives of this game:

- Learning Obj.#1: Deepen knowledge of the value identification concept and value characteristics on construction projects.
- Learning Obj. #2: Augment understanding of project owners as a system and that the system has many and varied statements of value that might include conflicting requirements on projects.

- Learning Obj.#3: Gain the ability to communicate efficiently and come up with proper questions to elicit information from project owners and customers.

Additionally, after playing the game, participants should be able to (Learning outcomes):

- Learning outcome #1: Identify value propositions on a project based on project goals and client's needs and translate them into design solutions/criteria.
- Learning outcome #2: Evaluate different design alternative against the value propositions.

The following sections explain the game rules and roles. Then later in the paper, the discussion section will relate between the mentioned learning objectives and outcomes and the results of the game.

GAME ROLES, RULES, AND THE STORY

The game includes four steps. In the first step, the game facilitator invites students to team up and form a design team of 4-5 people. We ask participants to select different roles: one to two architects, one structural/civil engineer, one electromechanical engineer (MEP) and a contractor. Based on their background, they need to provide suggestions about the general design. But first, the facilitator needs to present to participants a script that includes a general description of the owner's vision – and end-users' preference if applicable – about the project. This script acts as the design brief for the project. In our case, we opted to experience the game on a two-floor private villa. The owner, which is basically the end-user in this case, offered their vision of the project. The owner submitted a short design brief, and we shared it with participants during the two trials. The text reads as follows: "*The house is located in a mountainous area facing the ocean. The owner is interested in sustainable designs and solutions. The owner has a lean thinking background. The owner would like to connect with nature. The owner has a tight budget.*" We mentioned that the 'owner has a good position in society'.

Next, the facilitator asks participants to discuss with their team what is considered of value for the project based on the description of owner's requirements or the general vision provided. In other words, the participants need to come up with suggestions of how the brief description could be translated into value propositions and design requirements. Each team should agree on the top five value criteria that need to be achieved during the design to have a project compatible with the client's vision. The team shall write the five design value criteria on the evaluation card provided – or in the google sheet provided (Figure 1). It is important that the facilitator recommends that participant be specific when listing the value criteria. As a modification, and based on the two trials we conducted, we suggest adding another column and splitting the brainstormed ideas into value propositions and design specification. The design specifications are translation of the value propositions. The team converts these value propositions into design solutions or technical solutions. For instance, a value proposition can be having natural light as a way to connect to nature, then the design solution related to this value could be designing large windows. When participants start to list the value propositions and the translated design solution, they would come across conflicting requirements. Going back to the example, having large windows to connect with nature will not be specifically sustainable since it would lead to pressure on the heating and cooling systems. The participants will need to figure out how to better resolve the conflicting design solutions through alternative design ideas.

Figure 2. Value Identification Card (Google sheets)

In the second step, the facilitator presents three design options for the suggested villa. Each team will need to evaluate the design options against their list of design value criteria. The scale used was 1-10, where 1 indicates the presented design option poorly reflects the design value criteria and 10 represents an extremely compatible design with the listed criteria. The team calculates the total score per design option out of 50, which is the sum of the grade number given for each of the criteria. The three options need to have a similar representation, so all three designs need to be presented in 2D and 3D. Preferably, the north side shall be revealed beside the plans as this would help in deciding about sustainability and energy-related concerns. A sample illustration for the three options is presented in Figure 3. The samples were collected from *pinterest.com* website. The purpose of these samples is to give an idea of what might be a good fit for the game. Any design would do, the important thing to keep in mind again is the story behind these designs and how to conduct the discussions after receiving the evaluations.
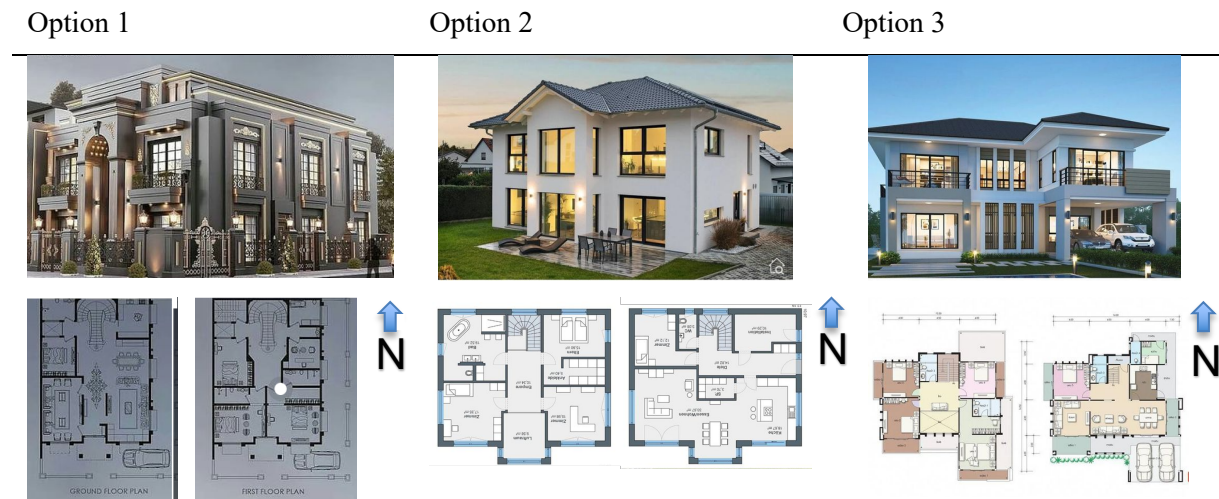

Figure 3. Sample illustration of the design options (not to scale)

In the third step, the facilitator elicits the scores per design option from each team. One representative from each team shall give an overview of the brainstorming process that helped in developing the value criteria based on the design brief. Afterwards, in step four, the facilitator will ask some questions to open a discussion and will need to talk about the story behind this exercise.

The discussion shall include two questions: (a) What did you notice during the teams' discussions on value identification and scoring the different options? And (b) what are some

efficient ways that might improve the process of identifying value, revealing hidden needs, and improving satisfaction on projects? These two questions can generate ideas, specifically regarding collaboration among the different design disciplines and asking the right questions to reveal needs and design style.

As for the story behind this exercise and the design options, the facilitator shall explain that the options are design alternatives for the same project and were done in chronological order. Option one was the first design the architect provided to the client. The architect assumed that given the client's position in society, they would want a luxurious villa. The architect explained that the material used could be affordable to minimize cost. The architect wanted to impress the client. Therefore, option one needs to be the wildest. Obviously, this design option will still be over budget and does not match the lean thinking the client has. At this point, the client did not know what exactly the alternative should be but indicated that a simple design would do. Then, option 2 would be suggested. The design is now simple with huge windows opening to enjoy the mountainous views. The client realized one problem with this design which is the absence of balconies and terraces on the upper level. The design also would be costly for the heating and cooling systems. Thus, the designer reimagined the project as depicted in option 3, where balconies and windows with louvers were provided.

CLASSROOM SIMULATION

The first run of the proposed game was conducted by the authors as a simulation exercise in a lean construction graduate class at the University of Alberta. The selected project for this first trial was a real case study the authors were involved in. The options were the actual design alternatives. The four steps explained earlier were conducted.

After the teams were done with listing value propositions, rating the options, and discussing their thoughts, the authors explained that these options are design alternatives for the same project and read out the story. This was the AHA moment for the students. It was then clear for them that iterations in design are inevitable, yet to reduce these, design teams need to conduct deep conversations with the owner and collaborate early on the project. The authors then explained about the value concept and how to reach a shared understanding of what is of value on projects.

Students Input

We invited students to engage in discussions based on multiple questions after the game concluded. One question asked students to congregate a value criterion that they perceived as the owner's hidden value (implicit need) and explain their selection. This triggered a discussion about the meaning of hidden needs or implicit value criteria. It was confusing to students at first, but the authors explained that the more questions the design team asks, the more implicit needs are revealed. We usually refer to the design thinking bootcamp from Stanford, indicating *"Engaging with people directly reveals a tremendous amount about the way they think and the values they hold. Sometimes these thoughts and values are not obvious to the people who hold them. A deep engagement can surprise both the designer and the designee by the unanticipated insights that are different from what they actually do - are strong indicators of their deeply held beliefs about the way the world is."*(Plattner, 2010).

Another question was raised and intended to gather strategies that students think are important for understanding the clients' requirements and enhance delivering value on projects. Responses included:

- Early involvement of different design professionals and contractors
- Open communication and collaboration
- Ongoing open discussions; pick owner's brain
- The use of visuals and providing sample design styles

Finally, the authors asked students what were some characteristics of value that they might have picked up from this exercise. In this discussion we highlighted the dynamic nature of value where designers need to keep in touch with the owner/end-users and update them on the progress as some needs develop with the proliferation of more information (Khalife & Hamzeh, 2019).

LEAN CONSTRUCTION EXPERTS' SIMULATION

The authors presented and played the value identification simulation game with a group of lean experts and enthusiasts to further test the effectiveness of the developed game. This group gathers monthly for the purpose of testing and playing educational simulation games related to lean concepts under the name APLSO: Administering and Playing Lean Simulation On-line. The advantage of playing the game with this group is conducting a plus-delta session after the game to highlight the advantages and the deltas or areas that need improvement. These are highlighted in Table 1. More deltas were recorded but were not mentioned because they are already incorporated into the game, examples: consider putting everything in the same level of presentation, include a 3D perspective with all options, and include roles for the team members.

Table 1: Pluses and Deltas on the value game received from the APLSO Group

Pluses	Deltas
Original game design	1. Add cost/ influence graph?
Like the story behind it	2. Cost is not a criterion, but a constraint; so best not to include this as a criterion or it will create confusion in the lean community.
Liked the lesson behind it- owners need some input from designers to learn what they want	3. Owner has information and designer has missing information; therefore, need to build a bridge between the two; example: have a table with both their input
The game generated good discussion	4. Need two groups: tangible versus intangible
Different team members have different perspectives	5. More information on the site and energy efficiency/ mechanical systems

About the deltas, the points one and two answer each other. During the discussions, one of the attendees suggested adding cost or influence graph to the options, yet another participant from the lean experts said that cost should not be a criterion. If the game included cost, mostly participants will focus on that as the basis for their decision among options, therefore it was not logical to include it. Delta 3 cannot be incorporated because the goal of this exercise is to get the design team to discuss more with the limited information at hand. For delta 4, it would be hard to make one group focus only on the intangibles. In the end even intangible value criteria need to be translated to tangible design solutions. That is why we suggested splitting evaluation card into value propositions and design solutions. As for delta 5, this might be a good suggestion for future trial and implementation. The authors could add few information without being very specific so participants would not get affected by comparing numbers.

DISCUSSION

The value identification game is meant to be part of the lean simulation games that help in teaching lean concepts. The value concept is part of the wicked problems in the project definition phase, where wicked problems in design are associated with stakeholder needs and values (Whelton & Ballard, 2002). Therefore, to help students in understanding the value concept and the associated hurdle with identifying stakeholders needs, the value identification game is proposed. Based on two trials and feedback from lean experts and practitioners, the

game was modified and presented. In this discussion part, the authors highlight the common points identified from the game trial discussions:

- At the start of the game, there was still a misunderstanding of how to translate the requirements into value propositions. After the discussions, participants had the AHA moment.
- The design brief is considered a mechanical outcome, we would rather want a value outcome on projects where human-centred design is essentially the target.
- Team alignment is part of the project value concept, where teams needed to collaboratively agree and brainstorm ideas in this game. People not agreeing on value definition is already value loss on projects.
- The more in-depth discussions took place, the more ideas were generated. Collaboration is the key.
- Players go through definition, development, negotiation, evaluation, so they move from the value definition to value alignment phase, then later value delivery can take place.
- Designers need to avoid projecting personal thoughts; instead, designers need to coordinate their perception of design.
- Participants need to clarify the tangibles that reflect the value propositions, since the only thing provided to them is the design of the house without any further input from the owner.
- In reference to the Johari window, the game focuses on the third quadrant and touch base on the fourth. The participants will be trying through this game to extract more information based on the available description. It is good to include the Johari window at the end so participants can relate to what they are doing in the game.

To sum up the take-aways from the game, Figure 4 is provided as part of the presentation that the facilitator could provide participants with by the end of the game.

Figure 4. Value take-aways from the game.

Finally, based on the discussions in the two trials, the authors could assess that the learning objectives were met. Participants had gained more knowledge about the value identification exercise after the game, and they learned about the value being dynamic from the story behind this game. Participants also came across conflicting requirements. The facilitator highlighted the need to ask questions and collaborate to elicit more information than what is provided usually by owners and participants learned about this strategy. It might be relevant to mention

the design thinking approach and human-centered design with this game. Design thinking is known for investigating human needs, scoping, defining the problem at hand, personas understanding, user experience mapping and more. The game relates to the first two stages of design thinking: empathize and define. Emphasize is where the designer sees the world from the user's perspective, understands their feelings and motivation, and communicates their understanding. Define stage is where the designer collects ideas to present functions needed to solve problem at hand, similar to the approach in the game. Therefore, mentioning design thinking helps in establishing the connection and explaining that value needs to be delivered in any product not only construction projects.

CONCLUSIONS & FUTURE DIRECTION

This paper proposes a value identification game to help students and novice practitioners in understanding the concept of value and learn to define value propositions through interactive means and observations of different viewpoints. The game includes four steps starting with brainstorming ideas to elicit what is important on the project given the project brief and listing them as value criteria and design solutions. The team of different disciplines will need to coordinate and discuss if there are conflicting requirements identified. Then, the facilitator will provide 3 design options and ask the team to evaluate these against the value criteria listed. In step three, the different teams share ideas and see which option got higher scores. Step four constitutes the main discussion, where the facilitator tells the story behind the games and the options provided and asks provocative questions. Participants will learn that projects normally comprise conflicting requirements, which means they need to deal with these and be informed about the strategies to mitigate the conflicts. Through this game, the authors highlight the issue of hidden needs and the dynamic nature of customers' requirements and the value they perceive of the project. Collaboration and team alignment are also important takeaways from the game. Open candid conversations need to take place because even knowledgeable owners take time into the process to figure out their needs. This idea is often overlooked, and owners are expected to express their need upfront in the design.

After conducting the game in a graduate class setting and with lean experts, positive feedback was received, and possible future additions can be considered. On a final note, the authors had come across the recent trend in design. Artificial intelligence has found its way into developing design concepts using AI art generators. Recently, we have been witnessing design engines that use AI to generate design photos based on a set of words that describe the project. It kind of resembles the current game setting, where the design team are requested to filter out the design options based on the set of value attributes or value propositions inspired from the brief. A future version might be considered which includes comparing the effect of these AI generators and their adaptability to generate design solutions based on the keywords being the top value attributes identified.

Finally, lean philosophy has people at its heart. Value is deeply correlated with social impact, social justice, and equitable living. The game could be tailored to reveal such important ideas. The game conductor may opt to provide a hospital project as an example, or an elderly care center, or a rehabilitation center. The authors believe in visuals and interactions to highlight important ideas in connection with delivering value on projects.

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