ON THE BACK OF A COCKTAIL NAPKIN: AN EXPLORATION OF GRAPHIC DEFINITIONS OF LEAN CONSTRUCTION

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ABSTRACT

Quick descriptive sketches made on the backs of cocktail napkins are a tradition in the architectural profession and are representative of the visionary conversations that take place between business associates in relaxed venues where fresh ideas are sometimes first hatched. In this paper, we propose the use of this technique to better convey and capture the principles of the growing and evolving discipline of Lean Construction. Whether they occur in academic classrooms or professional worksites, exploratory conversations about Lean Construction also suggest there may be a need for an easy-to-understand, easy-to-represent graphic definition ("cocktail napkin sketch") that can quickly communicate key components of lean thinking to those wishing to understand and potentially implement lean. This paper shares an exploratory analysis of the results that emerged from cocktail napkin exercises administered three times from Feb 2011 to April 2012: at an IGLC mid-year meeting in New York, NY; at an LCI workshop in Houston, TX; and at an LCI-Academic Forum in Boulder, CO. Finally, the authors propose a graphic definition of Lean Construction, distilled from submissions made during these events that might serve as a potential starting point for future discussion and refinement.

KEYWORDS

Lean Construction, cocktail napkin exercise, simulation, lean definition, graphic representation

INTRODUCTION

The roots of lean are embedded in the Toyota Production System, which stands on two pillars that represent continuous improvement and respect for people (Liker 2004; Ohno 1988; Womack and Jones 2003). Two organizations breathed the term "Lean Construction" into architecture, engineering and construction industry

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parlance: the International Group for Lean Construction (IGLC) in 1993 and the Lean Construction Institute (LCI) in 1997 (Sayer and Anderson 2012).

Lean manufacturing has inspired Lean Construction (LC), but as the LCI and IGLC communities have grown, and as additional lean thought leaders have emerged over the past 20 years, definitions of LC have assumed various and nuanced forms as well as extensions of the definition of LC to include practices emerging from within these communities. Despite this, there has been resistance from the LC community to commit to a collective definition of lean.

Oscar Wilde is quoted to has said "to define is to limit," and Thomas Reid asserted "there is no greater impediment to the advancement of knowledge than the ambiguity of words." Wilde's comment is compelling. Nevertheless, Reid also has a point; defining a concept can focus a community's resources to help it meet its goals.

Definitions of LC have included the holistic pursuit of continuous improvement with a goal to deliver customer value, while minimizing waste and maximizing value to the customer throughout a project's delivery process and life cycle, and while respecting all stakeholders in the value chain (AGC 2013; Abdelhamid 2013; Forbes and Ahmed 2011; Koskela et al. 2002; LCI 2013; Santorella 2011). Koskela (2000) writes of conceptualizing production simultaneously from three points of view: transformation, flow and value.

Definitions notwithstanding, critics of LC have described LC as a "complex cocktail of ideas" (Green 2002, p. 148; Green and May 2005). Others have observed that two divergent branches of lean construction thinking have emerged: Koskela's theory of "Tranformation Flow Value" and Ballard's Last Planner System of Production Control (Ballard 2000a)—a system that has become almost synonymous with application of lean—and wondered how the gap between the two branches might be bridged (Bertelsen 2002; Bertelsen and Koskela 2004). Naney et al. (2012) argued that LC's adoption in the construction industry needs to be accelerated in order to reach a tipping point and attain more wide-spread relevance in the industry—and implied that the diffuse nature of the LC concept is partly responsible for holding back more rapid adoption. There are also concerns that some individuals only understand LC's hard skill requirements (i.e. engineering processes of flow, kanban, batching, work-in-progress, and just-in-time delivery), but neglect essential soft skill requirements (i.e. respect-for-the-individual and the cultural side of lean thinking; Liker 2004; Santorella 2011). Finally, some LC educators have been rebuffed by company representatives who claim their employees already practice lean-like techniques, rendering LC implementation unnecessary. We believe these comments indicate that pockets of practitioners have independently arrived at realizations similar to those practiced by the LC community. However, while many companies may implement lean-like practices wherever possible, it is also likely their efforts are sporadic and dispersed. As laudable as these attempts are, LC demands a full-throttle, collaborative, systematic, and company-wide effort to be implemented at all levels of an organization. It is precisely because LC practices should be implemented in such a committed manner that it requires a shared understanding of what LC actually is—and perhaps more importantly—*what it is not.*

Lean thinking has become important to the construction industry because construction has traditionally contended with a concept known as *time-cost-quality trade-off* (Feng et al. 1997; Hegazy 1999; Siemens 1971), where the metrics of

success—time, cost, and quality—may be viewed as a three-legged stool (Jackson 2010) or even an interdependent pulley system. Improvement in one of the three metrics necessarily forces the sacrifice of one or both of the remaining metrics; i.e. if costs must be reduced, then either time or quality—or both—must suffer (personal communication, Jorge Vanegas 2010). By contrast, the Lean Construction Institute, and the lean community at large, challenge the commonly held belief that there is always a trade-off between time, cost and quality (LCI 2013). The authors of this paper accept the LC community's challenge and suggest extending the proverbial three-legged stool to include not only time, cost and quality (inclusive of sustainability aims)—but safety and morale as well—where morale serves the human factor which is an essential component of the means of production. The metrics of time, cost, quality, safety and morale are already inserted into the "pediment" of Toyota's house of lean graphic (Liker 2004; fig. 3-3, p. 33) and will become part of this paper's final, proposed LC graphic as well.

This paper explores graphic definitions of lean by asking volunteers to illustrate their understanding of the meaning of Lean Construction on a cocktail napkin. The medium of a cocktail napkin was selected because of the legendarily informal setting in which new building construction ideas are sometimes hatched among building professionals. A quick sketch on a cocktail napkin may be a building stakeholder's one opportunity to quickly explain to an owner how and why a project should adopt a lean project delivery system.

METHOD

This paper represents an analysis and application of results that emerged from cocktail napkin exercises administered three times from Feb 2011 to April 2012: at an IGLC mid-year meeting in New York, NY; at an LCI workshop in Houston, TX; and at and LCI-Academic Forum in Boulder, CO. In each case, administration of the exercise was intended to be informal and exploratory, discursive in tone, and mutually educational for both participants and facilitator. The number of participants during each session ranged from approximately one dozen to nearly one hundred. At the start of an exercise session, each participant was issued a single, white, napkin. Participants were then asked to imagine a scenario where they needed to quickly describe—by sketching on the back of a cocktail napkin—the meaning of Lean Construction to a building owner who was potentially interested in trying out lean on a project for the first time. This is similar to the well-known metaphor of the elevator speech for a business idea, and the process of quick, graphic exploration is described in a book by Roam (2008). The allowed sketch time was approximately 10 minutes, primarily because of the limited time available for the presentations, but also because having a limited window of time in which to convey essential LC concepts is a realistic scenario. Up to three volunteers from the audience were then invited to reproduce their sketches on a large white board at the front of the room. After the sketches were reproduced, another volunteer from the audience was invited to decipher the white board sketch and provide a verbal description of his or her interpretation. This last activity was intended to reflect the effectiveness of the sketch in communicating an overview of the LC concept.

CONTRIBUTIONS FROM PARTICIPANTS

The following is a sampling of some of the sketches received by participants. A published, graphic definition of Lean Construction does exist and is available in Ballard (2000b)–the publicized five overlapping triad diagram that goes by the LCI trademarked title "Lean Project Delivery System (LPDS™)." However, in none of the three sessions did anyone attempt to reproduce it. Some participants, formally schooled in lean principles, drew a simplified version of the house of lean published in Liker's *The Toyota Way* (2004; Fig. 3-3, p. 33). One participant illustrated the benefits of shared understanding associated with Target Value Design (Figure 1a) and another participant's sketch represented the improvements to time, cost and quality experienced during a lean transformation (Figure 1b).[4]

Figure 1a & b. Examples of cocktail napkin sketches by participants, Cynthia Tsao (left), and Fritz Gehbauer (right).

On a napkin shown in Figure 2, the various overlapping phases associated with lean and Target Value Design were mapped.

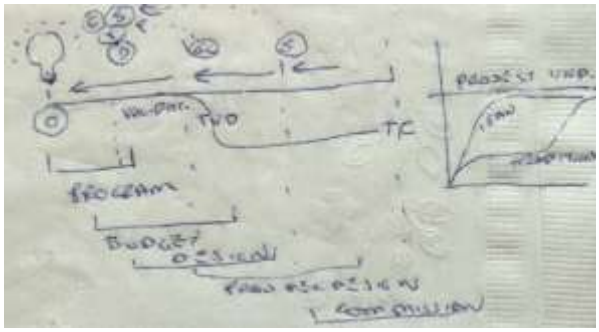

Figure 2. Example of cocktail napkin sketch by participant, Dick Bayer.

PROPOSED GRAPHIC DEFINTION OF LEAN CONSTRUCTION

One purpose of the cocktail napkin exercise was to help inform our own graphic definition of LC. We have enlisted the help of the LC community to explore ways to graphically represent the concept. The graphic we now present here has been informed, in part, by feedback from those who participated in the cocktail napkin

[4] Please note that the captions of Figures 1a, 1b and 2 have been modified from those published in the original conference proceedings to respect the citation preferences of exercise participants. Also, one of the images originally included in Figure 2 has been deleted, also to respect the expressed preference of that participant.

exercise. Central to the graphic is the continuous improvement cycle because it serves as the fundamental engine of lean (Figure 3). We chose to represent the conventional Plan-Do-Check-Act (PDCA) continuous improvement cycle as Plan-Implement-Measure-Assess (PIMA) because it was felt the latter acronym more precisely describes the actual steps involved during continuous improvement. The acronym OAEC stands for Owner, Architect, Engineer and Constructor and resides at the heart of the PIMA cycle. The reminder of OAEC involvement during the PIMA process is important because it ensures that continuous improvement recommendations are fully informed by designated parties working in an integrated and collaborative environment. OAEC involvement is also part of the "culture of respect" for people which reminds participants that "with every pair of hands comes a free brain" (personal communication, Tariq Abdelhamid 2012).

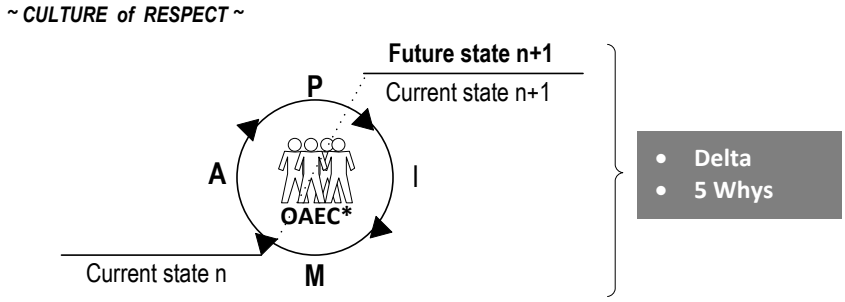

Figure 3. The PIMA continuous improvement engine of Lean Construction.

The addition of "delta" and "5 whys" root cause analysis to the PIMA cycle diagram reminds us that existing lean procedures help: (a) identify the gap between the current and future state (the "delta" from "plus/delta"), and (b) explore underlying countermeasures that may be implemented to bridge the gap (5 whys). Each PIMA element is part of a larger PIMA chain (Figure 4) where one current state (n) is transformed into the next and improved future state (n+1). The horizontal axis represents the time over which a process is developed and improved. The vertical axis represents the metrics of time, cost, quality, safety and morale associated with the life of a project. Note that these metrics improve as the continuous improvement process progresses over time. Note also that improvement for time and cost generally are considered optimal as they progress toward a minimum state, but that quality, safety and morale become optimal as they progress toward a maximum state. Actual values representing maximum and minimum amounts will likely change as technology improves.

Below the horizontal axis in the composite graphic (Figure 5) is a graph derived from Fernandez-Solis and Rybkowski (2012) that represents % of capital cost (first cost). The graph illustrates that, as the continuous improvement process progresses, the amount of capital resources spent on wasteful processes can be re-allocated to processes that provide value to the project (Figure 5). Note there are two potential outcomes for this waste-value inversion; as waste is removed during continuous improvement, lean can either deliver a project of equal value for less first cost than

was originally planned, or of greater value for the same first cost as that which was originally planned.

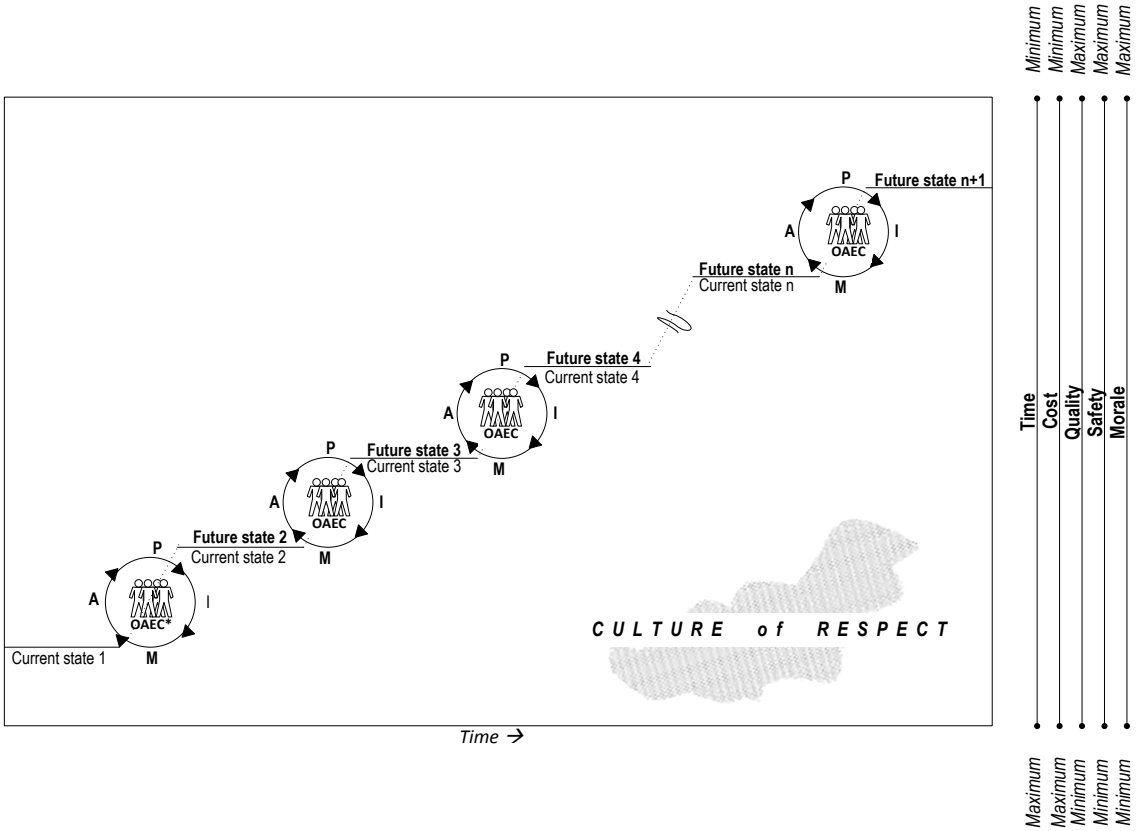

Figure 4. Chains of PIMA along a time continuum.

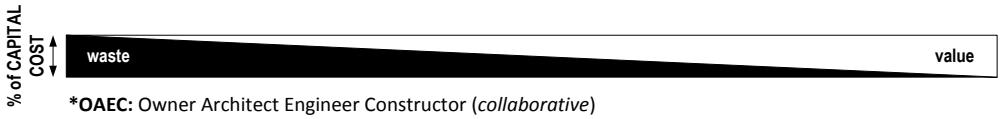

Figure 5. Inversion of waste and value (after Fernandez-Solis and Rybkowski 2012).

The grey strips in Figure 6 represent examples of observations that can be expected as the continuous improvement process progresses. For example, if true waste is removed and processes become streamlined, parallel schedule flows start to emerge (represented by the upper grey strip) and are visible when one uses line-of-balance scheduling programs and techniques. Similarly, value to the owner improves (represented by the lower grey strip) and is made explicit when implementing systems such as *Choosing by Advantages* (CBA; Suhr 1999). With CBA, capital cost of a design alternative being considered is represented along the x-axis of an x-y graph; importance to the owner is represented along the y-axis. The lower grey strip depicts how the numerator or y-value of an importance per cost ratio increases as a process becomes increasingly lean. In other words, when properly implemented, LC

processes can be expected to bring a project greater value for money or "bang for the buck" (personal communication, Todd Henderson 2012).

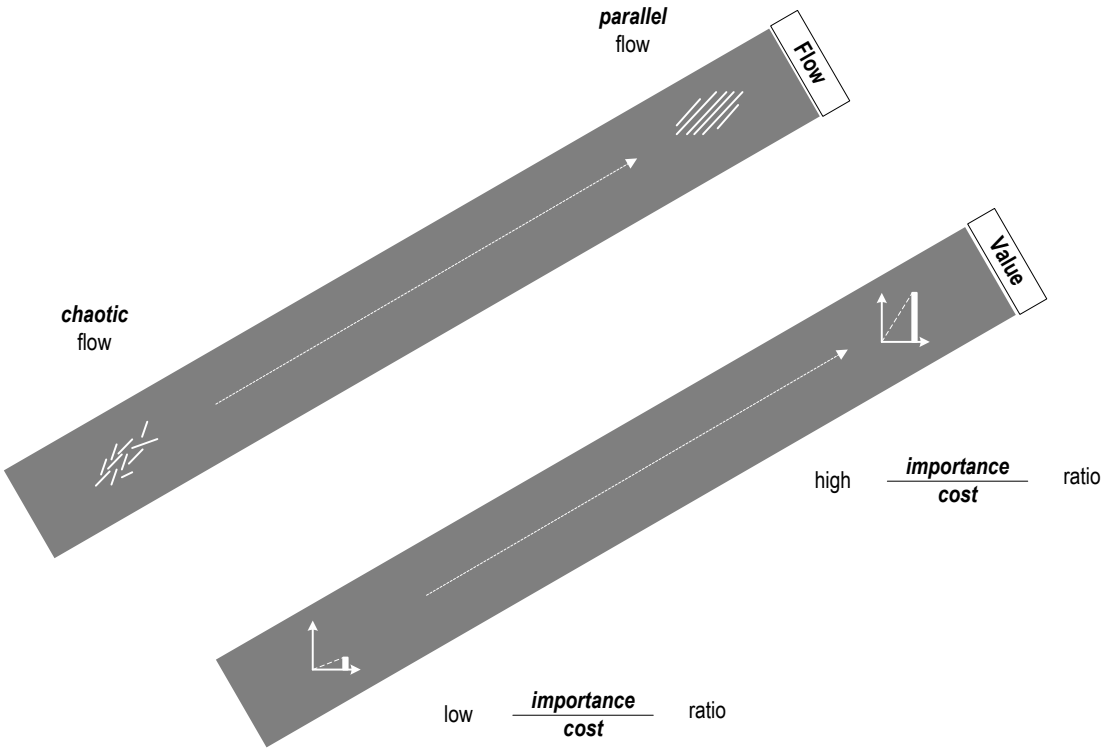

Figure 6. Progress toward *parallel flow* (top) and increased *importance per cost* (bottom)

When Figures 4, 5 and 6 are superimposed, the composite sketch (Figure 7) summarizes the "who, what, where, how, when and why" of LC. For example, one might argue that the *who* of LC includes all critical members of the OAEC team, the *what* is to "eliminate waste and add value," the *how* is "through continuous improvement and within a culture of respect," the *why* is to "improve time, cost, quality, safety and morale," and the *when* is "along a constant time continuum."

DISCUSSION

Thanks to observed benefits and the continued efforts of the LCI and IGLC communities, LC is increasingly being practiced throughout the world. Despite this, some observers argue that the definition of LC is still too nebulous or complicated and that some practitioners mistakenly believe they are already implementing LC when actually they are not or are doing so only sporadically. Some practitioners misunderstand the culture of LC, believing The Last Planner® by itself is synonymous with LC. Others argue that LC needs to reach a tipping point to be truly effective and that to spread more rapidly, the concept should be more clearly defined.

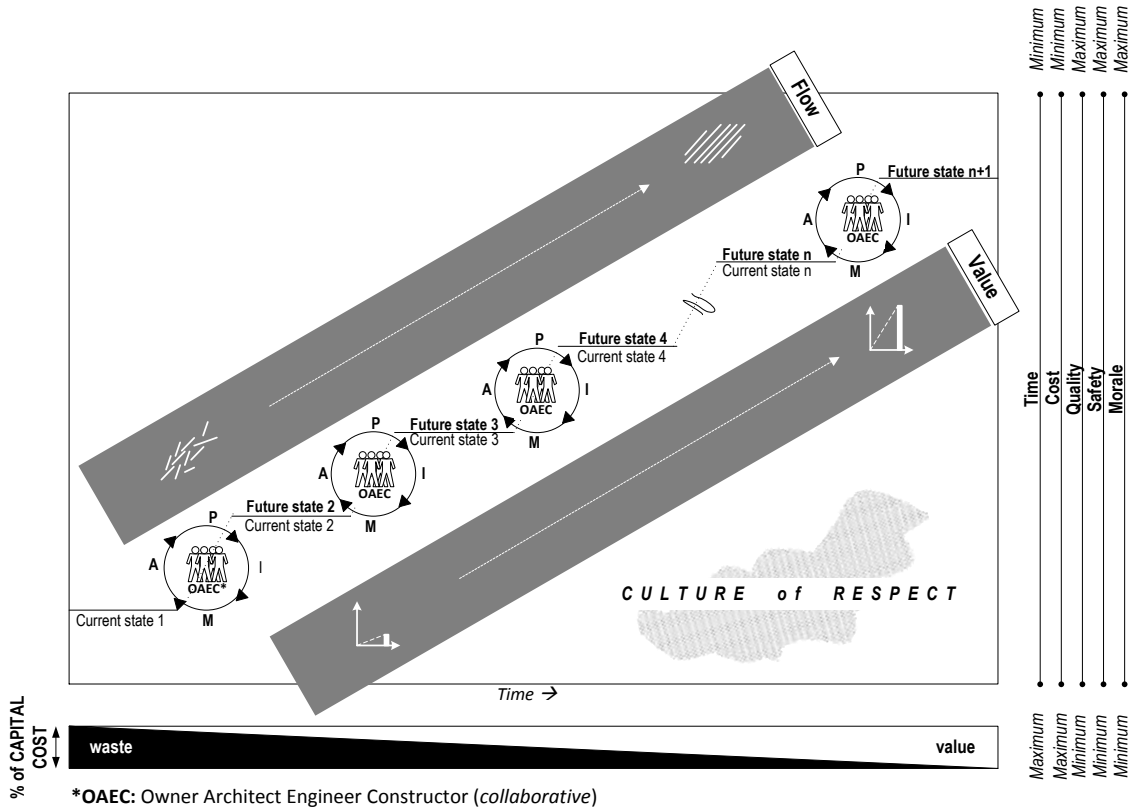

Figure 7. Diagram of Lean Construction (after Rybkowski 2012).

In a personal conversation, one of us asked Greg Howell and Alan Mossman why the question "What is Lean Construction?" never goes away.

Howell responded: "Is-ness is the problem for me. This is a computer, this is door. My definition: Lean is a new way to see, understand and act in the world. This works for me and is useless for most others. It surely would be better if we dropped the term lean. If not, how about: A path of continuous learning?" (personal communication 2010).

Mossman similarly asserted: "If someone asks 'What is lean construction?' I start by trying to find out why they want to know and what they already know. Then I have some ideas about how to respond. I feel that you are making a problem where none exists. Live with the ambiguity and help your students to do that too" (personal communication 2010).

Walter Gallie, the famous British philosopher, coined the phrase *essentially contested concept* to suggest there are concepts that inevitably involve endless disputes about their proper uses on the part of their users. The responses from Howell and Mossman beg us to wonder: Do we present LC as an essentially contested concept?

CONCLUSION

Despite varied opinions, this paper asserts there is value to being able to define LC graphically. It uses the back of a cocktail napkin to create an imagined yet realistic scenario where a lean stakeholder is asked to quickly describe lean. Trial runs of our "cocktail napkin exercise" reveal multiple ways to envision LC. Perhaps one appropriate metaphor is that these multiple visions of LC represent the proverbial blind men who are each touching a different part of a single elephant (e.g. trunk, tusk, leg, tail, side; Schmaltz 2003) and arriving at different conclusions about the final form of the elephant. We argue that, although these various descriptions might be equally correct, there is still value to trying to identify the overall form, if for no other reason than to be able to recognize that a giraffe is essentially *not* an elephant. Our experimentation with the cocktail napkin exercise represents an early attempt to capture an overall form for this elephant called Lean Construction.

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