

CHARACTERIZATION OF LEAN PROJECT DELIVERY

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ABSTRACT

Clear definition of any new philosophy, tool or method applied in the management of projects is required for successful implementation. Distinguishing the traditional practice based on the Critical Path Method from new practices inspired on Lean Project Delivery is important to explain, understand and support its growing acceptance. Lean Construction developed from tools and techniques applied in the construction phase to a philosophy resting on firm conceptual foundations applied throughout the project life cycle. New terms, "Lean Project Management", "Lean Project Delivery" and "Integrated Project Delivery", have emerged but there is no specific accepted definition or clear distinction between these terms and other project delivery methods. Whatever delivery method is chosen, all projects have Commercial Terms, Organizations, and an "Operating System" and are shaped by the culture and technology. Based on literature review, this paper aims to clarify these terms and provide a structure for understanding how Lean Project Delivery is distinguished from "Traditional Practice" beginning with the underlying strategy for optimal performance, and by a focus on three domains: commercial terms, organization and operating system. The paper proposes that Traditional Practice provides a well-developed and coherent approach that differs from Lean Project Delivery, a not yet completely coherent approach.

KEY WORDS

Lean Project Delivery, Lean Project Management, Project Delivery.

INTRODUCTION

The development of Lean Construction (LC) over the last 20+ years challenges Traditional Project Management (TPM). All projects have Commercial Terms, Organizations⁴, and an "Operating System" (OS) and are shaped by the culture and technology (Thomsen 2009). In TPM, selecting the most appropriate contractual form, often called the "Project Delivery System" (PDS)⁵, is understood as one of the most important decisions for a successful project (Mostafavi & Karamouz, 2010).

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4 The authority and communication rules that shape and limit behavior.

5 The term PDS should be understood here as a contractual mechanism where control is achieved by measuring the progress and cost of each activity. It is not a system in the sense of Project Based Production Systems. See Project Production System Laboratory P2SL Berkeley for additional information.

Project Delivery Systems (PDS) have been defined by a variety of professional organizations. According to ASCE (2000), a PDS describes how the Project participants are organized to interact, transforming the owner's goals and objectives into finished facilities (Chen 2011). According to AGC (Kenig, 2011), a PDS is a comprehensive process of assigning the contractual responsibilities for designing and constructing a project. AIA defines a PDS as the method selected to allocate roles, responsibilities, risk, and rewards among the parties accomplishing the design, preparation of construction documents, construction, and management of a construction project (CSI, 2011).

Traditional Project Management practice is a coherent contracting-based PDS frameworks developed and accepted by professional organizations such as Associated General Contractors of America (AGC), The American Institute of Architects (AIA), Construction Specifications Institute (CSI), Project Management Institute (PMI), Construction User Round Table (CURT), most academic research, risk management tools such as insurance and bonding, and training and education provided by trade schools, colleges and universities.

Three basic forms of PDS, Design-Build (DB), Design-Bid-Build (DBB), and Construction Management at Risk (CM@RISK) all rely on the activity-centered Critical Path Method (CPM) based OS. Traditional Project Management practice, contracting structure and practices and the resulting command and control organizations coevolved beginning about 1960 when CPM was introduced and became basis for the discipline of project management. All forms of now traditional PDS rest on an unspoken decomposition strategy for success: Optimize each piece to optimize the project. In practice, this means contracting for each piece at the lowest cost and using the CPM to manage the sequential dependence of activities. This is a sort of motivationist approach: pressurize participants on the critical path to complete their work in the allotted time and for the established cost.

DEFINING CHARACTERISTICS

According to AGC (Kenig, 2011) all PDS have *defining characteristics* that distinguish one delivery method from the other. Defining characteristics are structured in the following two questions:

- What is the contractual agreement between the project participants: the owner, the designer, and the contractor? Is the work in design and construction held under separate contracts directly with the owner, combined under one contract or separate but contractually bound by a single contract (relational contract) with the owner?
- Is total construction cost part of the criteria in the final selection of the constructor?

PDS characteristics or key factors are apparent from these two questions. The answers fall into two broad categories: Commercial Terms including selection, compensation, risk responsibility and allocation; and Organization for communication protocols and authorities. Risk in this model is understood to arise within each activity or be the result of an uncontrollable event. The concept and nature of the underlying OS and how it manages the work is absent.

THE RISE OF LEAN CONSTRUCTION

Despite the logic and promise of Traditional Project Management, many owners/customers remain dissatisfied: projects are dangerous places to work, they take longer than planned, cost more than anticipated, and the final product does not meet client quality expectations (Lichtig, 2006). In traditional practice, these problems are understood to arise because of inadequate communication, cooperation, coordination, and integration between stakeholders (Chan et al., 2004). People and organizations fail to do what was required at the right time. The ability of those pursuing project claims is hampered because projects are not always a series of sequentially related tasks where all the costs within an account arise within the account. More frequently, tasks are interdependent; the combined impact of uncertainty, unpredictable workflow and dependence reduce total system performance. Tracing the effect of an RFI can be impossible. The PDS itself was not understood as the source of the difficulty.

Lean Construction developed in an environment where projects were becoming more complex, uncertain, and dynamic. Lean Project Delivery is an innovation. It combines a new strategy applied to the OS that in turn calls for but does not require a different set of organizational communication and authority protocols and new forms of contract.

The development of Lean Construction began with the discovery of the obvious; workflow on projects is unpredictable. The Last Planner System® (LPS) developed as a countermeasure and produced immediate improvements in project performance. Pull Planning was invented because the CPM schedule was rarely accurate enough to predict the work needed to be made ready in the coming few weeks. The drive for Integrated Project Delivery began when it became apparent that innovation was limited by the ability to move money across boundaries. The power of collaboration became more apparent with the development of Target Value Design. The new strategy for maximizing project performance was revealed: Optimize the project not the piece.

COMPARING TRADITIONAL AND LEAN PROJECT DELIVERY

A summary of each domain of project delivery under Traditional and LPS are presented below. While each form of Project Delivery creates a coherent approach across the matrix in Table 1 below, projects can and frequently do mix and match. For example, it is entirely possible to apply a flow centered and collaborative organization under transactional contracts. And there have been at least two approaches that were created to optimize the project not the piece. "Partnering" is an attempt to create a collaborative project organization but its impact was muted and people often became cynical. This is an area for more research but it appears that the impact of Partnering was muted by the demands of the traditional OS and related commercial terms. Likewise, Design-Build Contracting changed commercial terms by simplifying the project into a single contract thereby reducing the competitive or adversarial organization. While DB does perform better than TPM, its use is confined to about 10% of the projects in the United States. Neither partnering nor Design-Build changed the OS.

Table 1: Comparison of Traditional and Lean Project Delivery

| | Organization | Operating System | Commercial Terms |
|-----------------------|---------------------|-------------------------|-------------------------|
| Traditional PM | Command & Control | Activity Centered | Transactional |
| LPD | Collaborative | Flow Centered | Relational |

In contrast to traditional PDS in integrated Lean Project Delivery, the Construction Management/General Contractor comes together with the owner and designer in the early design phases. As a result of this type of relationship is made up two teams, the IPD Team and the Core Group, each one delimited with functions and specific objectives for the project development. The purpose of the IPD Team, which is comprised architects, CM / GC, subcontractors, suppliers and owner, is to facilitate collaborative design, construction and commissioning of the project, creating an open and creative learning environment, where IPD Team members shall work together and individually to achieve transparent and cooperative exchange of information (Lichtig, 2008).

On the other hand, the Core Group, which is comprised the owner’s representatives, the architect’s representative, and the CM/GC’s representative, is responsible for the coordination, management, and administration of the project consistent with Lean Project Delivery principles (Lichtig, 2008).

One of the main differences between the traditional PDS and LPD is in the organization of the project. This includes the boundaries between parties, authorities and communication protocols. These are normally established in the commercial contract between the owner, designer and construction management/general construction (CM/GC). In the traditional PDS project participants come into their camps at various times during the project, such as: the designer is involved in the early stages and may have a participation in the construction phase, construction manager, if there is, may coming on in mid design, and general construction coming on after design is substantially complete. As a result, traditional projects have organizations that resemble silo or chimneys, with each camp organized vertically and separated from each other by contractual walls (Thomsen et al., 2009).

In conclusion, under LPD structure, organization and relationships among project participants is limited by formation of integrated teams, the IPD Team and the Core Group, and early involvement of key participants in the early stages of project development. This form of early involvement of key participants of the project also produces a change in the way of how the project is conceived. The Figure 1 shows a comparison between the traditional approach and LPD.

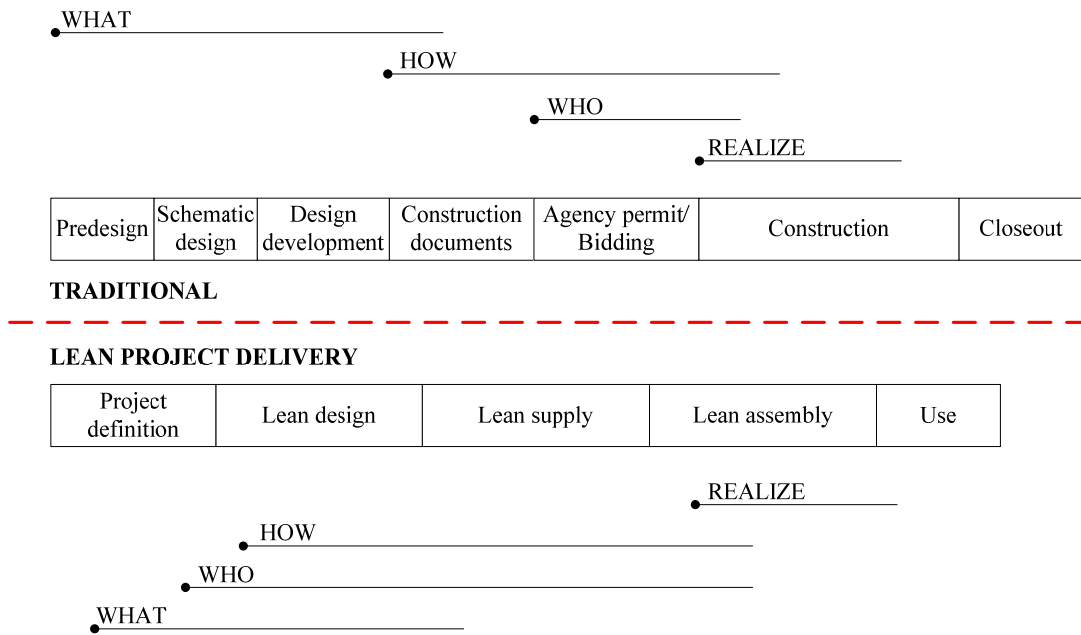


Figure 1: Traditional approach Vs. LPD – AIA (2007)

Finally, LPD with this kind of relationship generate a higher level of integration and communication between the participants in the project initial phases in order to maximize value and minimize waste.

COMMERCIAL TERMS

Another key factor in the characterization of LPD is the type of contract used. Compared with traditional PDS, using transactional contracts, LPD is based on the use of relational contract, since the foundation of relational contract is the recognition of mutual benefits and "win-win" scenarios through more cooperative relationships between contracting parties (Kumaraswamy et al., 2005). In addition, according to Cleves & Michel (2009), relational contracts create a system of cooperation, and shared responsibility, rewards and risks, all tied to the amount of value generate by the end product.

In the particular case of LPD, Lichtig (2006) developed a relational contract prototype known as Integrated Project Delivery Agreement for Lean (IFOA), which was created as an initiative for the development of the Sutter Health project (AIA, 2010; Lichtig, 2005).

The overall aim of this new relational agreement is addressed to support and facilitate the implementation of Lean principles and the five Big Ideas that were established for the project.

IFOA is a single contract that is signed by the owner, the architect, and the CM/CG, which describes the relationships that are established among each members of Integrated Project Delivery (IPD) Team. In addition, IFOA seeks to create coherence between the interest of the project and the participants and to align the interests of the project performers (Lichtig, 2006).

ALLOCATION OF RISKS AND RESPONSIBILITIES

In the traditional PDS the traditional risk transfer approach is still the most common method. Each party has specific individual obligations and risks are generally allocated to the party considered best able to manage them. The contract establishes the commercial and legal consequences where a party performs poorly or fails to fulfill its obligations properly (Figure 2) (Ross, 2009). In LPD, risk was reduced first by the measurement and improvement of the predictability of workflow. Risk is further reduced in IPD project because the parties collaborate to reduce uncertainty and to eliminate conflicts. Building Information Modeling (BIM) provides a powerful tool for teams to identify conflicts and opportunities for improvement. Risk is reduced because people can have new conversations about work in the future before they go to the field.

TRADITIONAL FORMS OF CONTRACT: TRANSFER RISK

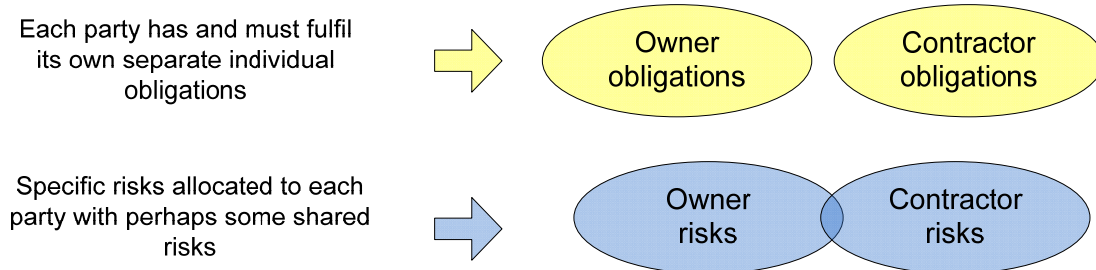


Figure 2: Transfer risk - (Ross, 2009)

In contrast to TM under LPD/IFOA, participants create a system of shared risk with the goal of reducing overall project risk, rather than just shifting it (Figure 3) (Lichtig, 2006).

SHARE & JOINTLY MANAGE RISK AND OPPOTUNITIES

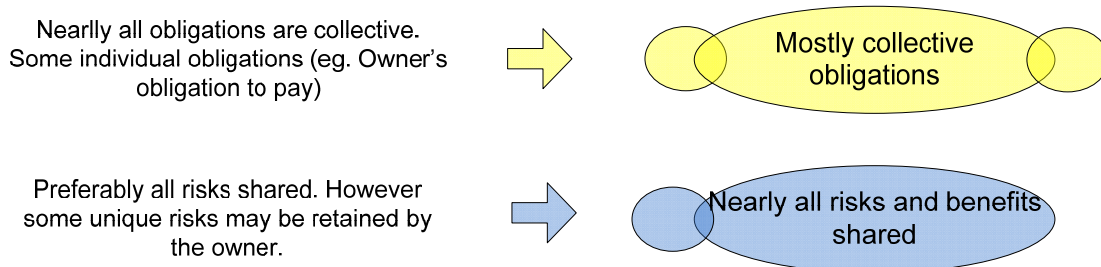


Figure 3: Collective sharing of risk/opportunity - (Ross, 2009)

COMPENSATION AND AWARD METHODS

The contract defines how project costs and profit are determined and reimbursed. Traditionally, the most common forms are: lump sum, guaranteed maximum price (GMP), cost-plus, Target Price and Unit price (Kenig, 2011).

The owner makes the final award of the project usually based on cost. The types most common are: low bid, best value – total cost, best value - fees and qualifications based selection (QBS) (Kenig, 2011).

The use of these forms varies depending on the PDS to be used for development of the project. The table 2 shows how commonly are used in the construction industry.

Table 2: Use common of type of compensation and award in PDS (Kenig, 2011)

| | LowBid | BestValue: Total Cost | BestValue: Fees | QualificationsBasedSelection (QBS) |
|------------------|----------|-----------------------|-----------------|------------------------------------|
| Design-Bid-Build | Lump Sum | Lump Sum | N/A | N/A |
| CM at - Risk | N/A | N/A | GMP | GMP |
| Design Build - | Lump Sum | Lump Sum | GMP | GMP |
| IPD | N/A | N/A | Target Price | Target Price |
| LPD | N/A | N/A | GMP | GMP |

In the case of LPD, particularly at Sutter Health project, team members were selected based on their expertise and capabilities (value-based) rather than the lowest price, and were compensated on a cost-plus fee basis with a guaranteed maximum price (Lichtig, 2006).

TOOLS AND METHODS

Lean Project Delivery encourages cooperation in the context of a single integrated team involving the owner, designer, constructor and other critical participants as equal in the pursuit of a shared goal (Mossman et al., 2010) by working together of the three domains. To accomplish this, and as previously explained, the organizational structure is conceived under the formation of teams working collaboratively, the commercial terms or contract type is developed in such a way that encourages teamwork, and therefore the OS must use tools and methods to facilitate teamwork and the applicability of Lean principles.

Lean Construction Institute has developed basic practices that bring the three domains together. The main methods used under LPD approach are:

- Last Planner System
- Target Value Design
- Set-based design

CONCLUSIONS

The research developed in Lean Project Delivery has been consolidated and strengthened each of the three basic domains where all Project Delivery Systems operate: integrated teams and early involvement, organizational structure; Last Planner System, operational system, and relational contract, type of contract or commercial terms. From this experience LPD can be more precisely defined and characterized not only as a philosophy but as another project delivery system.

One of the main characteristics of LPD how project delivery compared with traditional PDS: design-bid-build, design-build, construction management at-risk, etc.,

is a concerted effort to get that three domains working together in order to achieve the project success. Furthermore, another important feature is the way how to achieve the project goals, under an atmosphere of collaboration and integration that is enhanced by the use of relational contract.

Finally, the purpose of this paper was not to go into detail on each of the aspects with which LPD can be characterized, but to raise the idea that LPD can be structured under the focus of a PDS, that is a comprehensive process describing how the project participants are organized to interact and how to assign roles, responsibilities, risk and rewards among the project participants, and is characterized under some key factors such as the type of contract, organizational structure, award methods, type of compensation, and allocation of risk and responsibilities, etc.

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