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IS YOUR PROJECT PERFECT? USING FOUR-PHASE PROJECT DELIVERY ANALYSIS TO FIND HOW FAR YOU ARE FROM THE IDEAL STATE

Digby Christian[1], Jason Bredbury[2], Samir Emdanat[3], Frank Haase[4] and Zigmund Rubel[5]

ABSTRACT

This paper proposes a systematic approach for improving performance of any project regardless of type, location or jurisdiction. It focuses on assessing variances between the current state of an actualproject's delivery system and the ideal state using the framework of Four-Phase Project Delivery (4PhPD). This paper focuses on the questions that need to be asked and answered to uncover the key variances. Later, once these variances are assessed, customized strategies to reduce the variance can be formulated and introduced. The success of these strategies can be tested in further variance assessment iterations. Thus, a systematic continuous improvement strategy is created.

KEYWORDS

Theory, project delivery, kaizen, continuous improvement, lean construction

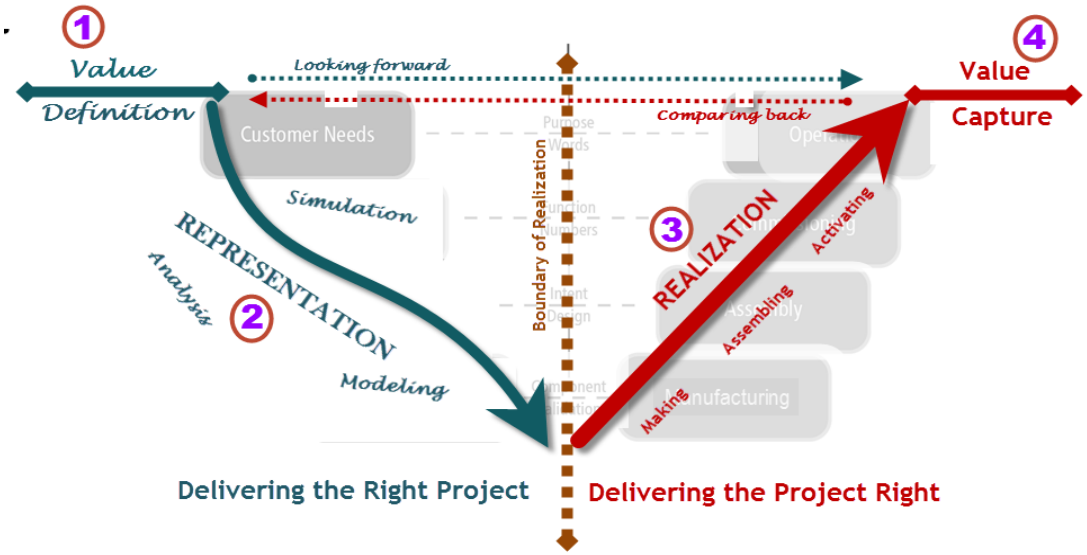
INTRODUCTION

Koskela and Howell (2002) in their conclusion pointed to the absence of any compelling theory of project management that could usefully be applied to help direct progress in project delivery. Additionally, nine years later, a research team at the Construction Industry Institute (CII) posited in their conclusion that an entirely new paradigm was needed to guide the implementation of successful project delivery strategies (CII, 2011). Also, it is true that there are at least six different ways of describing what a project delivery system is (Cho, et al., 2010, Table 1) and nine other ways of looking at project delivery systems in terms of contracting strategies

1 Senior Program Manager, Sutter Health – Facility and Property Services, Sacramento, California USA, chrisdig@sutterhealth.org
2 Program Manager, Lean Construction, SunPower Corp., Richmond, California USA, jason.bredbury@sunpower.com
3 Director of Management Services, Ghafari Associates, Dearborn, Michigan USA, semdanat@ghafari.com
4 Director of Virtual Design & Construction, Suffolk Construction, San Francisco, California USA., fhaase@suffolk.com
5 Co-Founder, Aditazz Inc, Brisbane, California USA, zigmund.rubel@aditazz.com

(Cho, et al., 2010, Table 2). However, the majority of these suffer from either being so general as to be difficult to build upon with pragmatic strategies or are so specific, they do not have broad applicability across project types.

Four-Phase Project Delivery (4PhPD) is a recent conceptual model (Christian, et al., 2014) that can be used to fill the theoretical void identified by Koskela and Howell (2002) and the CII (2011). Due to its broad applicability this model does not suffer from the shortcomings of the project delivery systems identified by Cho, et al. (2010). 4PhPD is summarized in Figure 1, below:



Phase 1: Value Definition. Is made up of the Human Concern, the Project Constraints & the Project Preferences.

Phase 2: Representation: Has to be analyzable against the Value Definition:

Phase 3: Realization. The Representation is realized and prepared for the Value Capture phase.

Phase 4: Value Capture. The Realized assets are activated to address the Human Concern.

Boundary of Realization: Point at which quantity & rate of resource consumption accelerates by greatest margin.

Figure 1

CII (2011) called for a new paradigm that would have Management by Means as one of its pillars. Management by Means emphasizes the abandonment of tight outcomes-based controls that react to deviations from the plan, and replaces them with a focus on the improvement of project processes, to reduce the chance that the project creates such deviations. The analysis proposed in this paper is essentially a Management by Means approach applied to the entire process involved in project delivery from inception to completion. The proposed process is also strongly allied with the fundamental lean concept of *kaizen* wherein "each incremental step in the continuous improvement process moves the process closer to the ideal state" (Stewart, 2011, pp.51). 4PhPD lends itself to this form of analysis as it explicitly describes the ideal state for each of its key phases. Within the process proposed in this paper, an ideal state is established and the distance of the current state from the ideal state is assessed.

SYSTEMATIC PROJECT DELIVERY IMPROVEMENT

4PhPD proposes the use of the lean concepts of ideal, current and future states to drive the improvement of any project delivery method. 4PhPD contains a definition

of the ideal state and proposes that an assessment be carried out to arrive at the current state. Thus, by comparing the two states, a future state can be proposed that moves the current state toward the ideal state.

- The overall methodology for systematic project delivery improvement is:
- Describe the ideal state
- Identify the current state and assess its variance from the ideal state
- Describe a desired future state where the variance is reduced
- Identify a variance reduction strategy to get to the future state
- Implement the variance reduction strategy
- Repeat steps 2 through 5 as needed to optimally align value definition and value capture

Steps 1 and 2 are the subject of this paper. Note that the assessment does not derive numerical metrics as it is the effort to assess the variance of the current state from the ideal state that is important. There is no creation of some notionally objective number to represent the project's "idealness". Instead, guidance questions are provided that are worded so that all answers can be qualitatively assessed the same way. The more often something is true or is happening, or the greater the extent to which it is true or is happening the closer it is to the ideal state, and vice versa.

Steps 3 through 6 are implemented by project teams in their quest for improved outcomes. Since these steps will be very much customized for each project's individual needs and priorities, they are not the subject of this paper.

FOUR-PHASE PROJECT DELIVERY ANALYSIS

A project's delivery method is broken down into the four phases of 4PhPD and each phase is analyzed as follows:

VALUE DEFINITION PHASE

The Ideal State

"In perfect value definition every stakeholder is properly identified and consulted, and each describes their value needs from the project with perfect clarity" (Christian, et al., 2014). In other words, in the ideal state the project team not only understands exactly who the project stakeholders are, but also understands why the stakeholders need the project. Also in the ideal state the team can articulate clearly the stakeholder constraints, and they can predict with complete certainty how the stakeholders will evaluate various possible solutions to the human concern.

Assessing the Current State

Strategies for assessing various projects against this ideal state are explored in what follows. The strategies include analyses of a team's understanding of the four key areas of the value definition phase, namely, the project stakeholders, their human concern, their constraints, and their preferences.

Area 1: Project Stakeholders

Project Stakeholders are those whose interests are affected by the project, or those that have influence over the objectives and outcomes of the project. By identifying

and engaging project stakeholders early, the project team would have the opportunity to understand the stakeholders' interests, their constraints, and their preferences. This understanding by the team would guide decision-making as solutions are explored and evaluated in order to find those that satisfy the human concern.

There are at least three main considerations when comparing the current state of stakeholder identification against the ideal state.

1. To what extent are clear criteria used to identify who the stakeholders are, and which of them would and would not be directly involved in defining the human concern?
2. To what extent is the impact of missing stakeholders in the value definition phase assessed and accounted for?
3. To what extent has the above information been documented, transmitted to and absorbed by the project team?

Area 2: The Human Concern

Projects exist to meet the needs of their stakeholders, and thus it can be argued that project teams who place emphasis on understanding the human concern are more likely to produce solutions that closely align with the project stakeholders' needs. Teams can consider developing metrics to define the human need and enable tracking and ranking of various options.

Areas 3& 4: The Stakeholders' Constraints and Preferences

Constraints are those non-negotiable needs of project stakeholders that must be part of the project team's solution to satisfy the human concern. Preferences, on the other hand, establish the criteria against which acceptable possible solutions can be ranked so that those most preferred are selected. Defining preferences using measurable values will help to rank and track preferences.

It is important to note that since projects are dynamic systems, the team's understanding of constraints and preferences will evolve during the course of the project. On some projects an attribute can start as a preference and later become a constraint and vice versa. The salient points to capture are: how well the team members agree on what constitutes a preference; what constitutes a constraint; and to what extent the team remains aligned with stakeholders as changes occur when the team evaluates alternatives, makes decisions, and makes trade-offs.

For the analysis there are at least four main considerations when comparing the current state to the ideal state with regards to the team's understanding of the human concern, project constraints, and project preferences:

1. To what extent do the stakeholders meet and mutually agree on the human concern, project constraints, and preferences, as opposed to meeting in a more fragmented fashion with the definition being an accumulation of potentially contradictory or incomplete definitions?
2. If efforts to attempt mutual agreement are made, how rigorous, reliable, and documented are those efforts?
3. To what extent are the aspects of the definition of the human concern, project constraints, and preferences specified in a way that could be quantified and measured?

4. To what extent has the above information been documented, transmitted to, and absorbed by the project team?

Without an explicit and clear understanding of the human concern and the stakeholders' constraints and preferences, project teams will find it more difficult to evaluate solutions, and will likely expend considerable effort in repeatedly engaging the stakeholders to validate their proposed solutions' fit against the human concern and the implicit preferences and constraints. More critically, if the evaluation criteria are kept implicit, the opportunities for optimization reduce, and there would be an increasing need to develop and present complete singular solutions versus solution spaces. The need to develop complete singular solutions contributes to over-production and increased rework when those singular solutions are found to be unsatisfactory by the stakeholders.

REPRESENTATION PHASE

The Ideal State

"During this phase solutions are represented perfectly and analyzed perfectly to verify with no chance of error that they meet the human concern, can be executed within the project constraints, and are compared against the project preferences to see which solution meets them most completely." (Christian, et al., 2014). Put another way, the ideal state of representation provides a foolproof way of predicting the future such that it is known with certainty during that phase that, once realized, the represented asset would yield precisely the desired value.

Assessing the Current State

Representation assessment is a combination of looking backward to the performance criteria of value definition (e.g. operational productivity, energy use) and project constraints (e.g. budget) and preferences (e.g. schedule – earlier is better) and looking forward to the realization phase (e.g. dimensional code compliance, constructability).

In the ideal state, representations are always as detailed as the later reality. The more detailed the representation the better since such detail inherently makes the representation more comprehensively and reliably analyzable backwards against the value definition and forwards against realization.

Assessment of the current state breaks down in to four primary areas of analysis. Three of these areas look backward at the value definition to evaluate the representation against the project constraints, project preferences, and human concern, and one looks forward to the realization phase, which evaluates the representation against constructability. Included in each of these four areas is an assessment of how well the team responded to the discovered variances from the ideal state.

Area 1: Analysis of the Representation against the Project Constraints.

There are at least six primary considerations:

1. To what extent is the project team aware of, agreed on, and reactive to the project constraints?
2. To what extent does the project team use the constraints to select viable solutions?
3. What is the level of detail of the representation of the physical scope?

4. What is the level of detail for any non-scope representation (e.g. line item budget, project schedule) that is used in the analysis against constraints?
5. How well connected to the scope representation is the non-scope representation? (e.g. is a detailed budget automatically changed every time a highly detailed representation is altered?)
6. How often are the representations analysed for conformance with the project constraints?

Area 2: Analysis of the Representation against the Project Preferences

There are at least five key considerations:

1. To what extent is the project team aware of, agreed on, and reactive to the project preferences?
2. To what extent does the team use the preferences to choose between solutions that satisfy the constraints?
3. How rigorous and reliable are the methodologies that analyzed the solutions against the preferences?
4. To what extent is the decision-making process that selected between solutions well documented, rigorous, and reliable?
5. How often are the representations analysed for conformance with the preferences?

Area 3: Analysis of the Representation against the Human Concern

There are at least four key considerations:

1. To what extent is the project team aware of, agreed on, and reactive to the human concern?
2. How rigorous and reliable are the methodologies that analysed the solutions against the human concern?
3. How often are the representations analysed for conformance with the human concern?
4. To what extent is a proxy human concern, whose satisfaction the project team has control over, used in place of the actual human concern, a criterion over which the project team has little or no control. For example, is "latest available medical technology" being substituted for "recruiting nationally recognized medical staff"?

Response to Variances

In the case of each of the three areas above, the way the team responds to variances should also be assessed. The following two questions can be asked:

1. How rapidly and completely does the project team respond to poor performance against the human concern, and against the project preferences, and to breaches of the project constraints?
2. How insignificant are the levels of rework associated with unsatisfactory levels of performance against the human concern, the project preferences, or with breaches of the project constraints?

Area 4: Analysis of the Constructability of the Representation.

There are at least six main considerations:

1. To what extent are rigorous and reliable systems and methods used to ensure what is represented is constructible?
2. What is the representation's level of detail when this analysis is performed?
3. How frequent are the iterations of the constructability analysis?
4. To what extent is this analysis undertaken by the people who would be responsible for project execution during the realization phase?
5. What level of detail does the representation reach just prior to transition through the boundary of realization into the realization phase?
6. How often are the representations analysed for constructability?

Response to Variances

As with the preceding three areas there are two key considerations:

1. How rapidly and completely does the project team respond to constructability issues?
2. To what extent have the levels of rework caused by constructability issues been minimized?

REALIZATION PHASE

Ideal State

"During this phase the selected solution is perfectly realized. It precisely aligns with the solution as represented in the representation phase. The solution is then activated so that it is fully ready for the value capture phase." (Christian, et al., 2014). In the ideal state, the realization phase has zero risk of failure because the representation was perfect and was analyzed to confirm with certainty that the value defined was intact and that the constructability was flawless.

Assessing the Current State

Realization can be split into two parts: First, the process of moving across the boundary of realization, and second, transforming representations of the project into tangible assets (see Fig. 1).

Area 1: Moving Elementsacross the Boundary of Realization

The Analysis

When moving project elements in the representation across the boundary of realization, the focus of the analysis is on the project team's recognition of the boundary's importance, and their actions in relation to this recognition. There are at least four main considerations here:

1. To what extent is the boundary of realization of each project element identified in the project's plan of work for each element?
2. To what extent has the project team identified for each project element the constraints and/or prerequisites that would allow movement across the boundary of realization with zero risk of rework?

3. To what extent has the project team successfully avoided rework by fulfilling the prerequisites, and removing the constraints identified in question 2, above?
4. Consider the sequence in which a project element moves across the boundary in relation to other preceding and succeeding project elements. To what extent has the team set up the sequence in a way that minimizes the overall risk of rework to represented and realized elements?

Area 2: Variances between Representation and Realization

The Analysis

There are at least four considerations here:

1. To what extent are rigorous and reliable methods used to identify variances between a realized element and a represented element?
2. How well understood by the project team are the root causes of the variances?
3. How rigorous and reliable are the methods which assess the impact of such variances on the value of the project as defined in the value definition?
4. How often is the realized aspect (be it scope, schedule, cost, or something else) compared to the representation?

It is important to note that the above considerations are not only applicable to the physical scope. The considerations are equally applicable to the represented construction work plan as compared to the actual realized construction sequence, or to the represented estimated cost of an element as compared to its actual realized cost.

Response to Variances

There are at least three key considerations here:

1. To what extent have the levels of rework in representation and in realization associated with such variances been minimized?
2. When a variance is discovered, how likely is it that an assessment of its impact on the value definition will be undertaken? And how thorough and reliable is that assessment?
3. Consider when the response to a variance is to change the representation rather than the realization. How rigorously was the impact of that change to the representation on the other unrealized project elements assessed?

VALUE CAPTURE PHASE

Ideal State

"During this phase the physical assets that were created and activated during the realization phase are used to address the human concern" (Christian, et al., 2014). In the ideal state, the value captured at the end of a project when the assets are put into operation aligns perfectly with the value defined at the start of the project.

Assessing the Current State

There are two main assessment questions for each of the three areas of constraints, preferences and human concern. These are:

1. How many of the quantified criteria defined in the value definition phase has the team been able to measure during the value capture phase?

2. How many of the non-quantified items has the team captured in a measurable way to inform future projects?

The assessment of the value captured covers the three areas of the value definition, namely the project constraints, the project preferences, and the human concern.

Area 1: Analysis of the Value Captured Against the Project Constraints

Beyond the two noted above, there are at least four key considerations here:

1. To what extent have the project constraints been complied with and, where they have been violated, how quickly were such violations discovered?
2. If constraints have been violated, how well has the team rationalized their decision to accept the solutions that do not meet the constraints?
3. To what extent have the impacts of any such violations been mitigated? For example, if the budget has been exceeded were any values tied to the human concern compromised?
4. To what extent have the impacts of the violations to any of the stakeholders been mitigated? For example, if the budget has been exceeded have measures been taken to minimize the impact on any other planned future projects?

The assessment of the impact of such violations to project constraints can be used to learn much about how important each project constraint actually was so that it can be emphasized more or emphasized less on the next project.

Area 2: Analysis of the Value Captured Against the Project Preferences

Beyond the two noted above under 'Assessing the Current State', there are at least three other key considerations:

1. To what extent were the project preferences satisfied?
2. To what extent did this level of satisfaction align with what had been predicted during representation?
3. To what extent are the stakeholders satisfied with project performance against the preferences?

Area 3: Analysis of the Value Captured Against the Human Concern

There is one key area to address, but it is perhaps the most important question to ask and assess on any completed project:

1. To what extent was the human concern addressed?

There are two additional questions for when a proxy human concern has substituted the actual human concern:

2. To what extent was the primary comparison against a proxy human concern?
3. How well did performance against the proxy human concern predict performance against the actual human concern?

In regards to this third question: if predictive performance is poor, then the key learning is to establish why it was poor, and what can be done better next time to create a proxy human concern that better predicts performance against the actual human concern.

CONCLUSIONS

This paper is a starting point for researchers and project teams who are looking to create assessment methodologies to analyze their project delivery methods with a view to systematic improvement in project performance.

Due to the broad applicability of the 4PhPD conceptual framework, any project can have its delivery method analysed in the way proposed by this paper to establish its current state for each phase; can assess how far that varies from the ideal 4PhPD state; and thus has the ability to establish strategies (Plan), execute them (Do), repeat the analysis proposed in this paper (Check), then start the cycle again (Act).

Finally, by using the common terminology of 4PhPD, such learning (about how to conduct analyses, and how to formulate and implement strategies) can be transmitted to, and absorbed by, many other project teams; and thus not only dramatically improve project delivery performance across industries and locations, but also the methods by which improvement strategies are formulated and implemented.

REFERENCES

Cho, S., Ballard, G., Azari, R. and Kim, Y., 2010. Structuring ideal project delivery system, In: *Proc. of Int'l. Public Procurement Conf.,* Seoul, Korea, August 26-28.

Christian, D., Bredbury, J., Emdanat, S., Haase, F., Kunz, A., Rubel, Z. and Ballard, H.G., 2014. Four-phase project delivery and the pathway to perfection. In: *Proc. 22nd Ann. Conf. of the Int'l Group for Lean Construction,* Oslo, Norway, June 25-27.

CII (Construction Industry Institute), 2011. Starting from scratch: a new project delivery paradigm, *Research Summary 271-1*, USA: CII.

Koskela, L. and Howell, G., 2002. The underlying theory of project management is obsolete, In: *Proc. of the Project Management Institute Research Conf., Washington, July 14-17.*

Stewart, J., 2011. *The Toyota Kaizen Continuum: A Practical Guide to Implementing Lean*. New York, NY: Productivity Press.