The Last Planner System in view of Promise Theory

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Abstract

This paper aims at proposing a new insight into the context of construction management from the Promise Theory point of view. The theory advocates decentralization and forming a network of localized components, connected to each other in a chain of promises. Such method has been examined in configuration management systems, knowledge management and virtual organizations, with reportedly successful results. There are also footprints of such pattern in agile practices, especially in SCRUM method. However, little, if any, research has applied such a pattern in lean construction methods. Promise Theory point of view helps in a better understanding of how the agents can be separated, while linked in a self-organized manner in the context of lean methods in general and the Last Planner System in particular.

Keywords: Last Planner System, Promise Theory, SCRUM, Lean Construction, Agility.

1. Introduction

The main principle of lean methods is reducing wastes via reinforcing quality assignments and reliability of promises (Hamzeh, 2009). The Last Planner System (LPS), as a lean construction method, is not an exception. The significant difference between lean methods and traditional project planning methods, e.g. CPM, is that in the former, the actors, i.e. the “last planners” in the LPS are participated in decision making, whereas in the latter decisions are made in a centralized manner, often far from the settings in which the actions take place, both in terms of distance and time.

By the same token, agile strategies focus on thriving in unpredictable environments, e.g. IT management. In other words, to be agile, an enterprise or project must be structured appropriately to proactively and quickly adapt to change, seizing such opportunities to enhance value outcomes(Owen, Koskela, Henrich, & Codinhoto, 2006). SCRUM, as an agile method, has provided a new insight into managing highly variable and unpredictable environments (Kniberg & Skarin, 2010).

There are slight differences between LPS and SCRUM, in terms of leadership style. In fact, the former follows a sort of consultative-autocrat leadership style, that is the project leader absorbs the information input from the team members, though makes the ultimate decision (Odusami, Iyagba, & Omirin, 2003), whereas the latter relies on a flatter, self-managing, team-based structure rather than close, hierarchical management. In this sense, the scrum master is very much seen as a facilitator who tracks the progress of the team, allows them to make commitments to each other (Cervone, 2011), enables small, self-organizing teams to decide for themselves how they satisfy their value goals(Owen et al., 2006). The removal of tiered management effectively removes communications overhead, as well as minimizing system noises (Bonabeau & Meyer, 2001). This can be regarded as a paradigm shift in project management practices, since most project managers opt for following a well-prepared plan and the ensuing fight to get back on the plan when things go wrong. Adapting agile methods to construction management context requires significant changes in infrastructures and internal systems, especially in large organizations.

(Burgess, 2015b) proposes a novel viewpoint, Promise Theory (PT), in order to model the relationship between agents in decentralized decision-making systems. This paper argues that with a change in the point of view, construction managers could take the advantage of self-managing, though scalable teams. To this end, the PT and the underpinning theories and approaches are discussed.

2. Promise Theory

In philosophy, a promise is defined as a concept related to morality (Sheinman, 2011). In business, promises are not only about morality as imposed onto the promisor, but also contain valuable information for management of expectations. In this context, PT is regarded as a model of cooperation between autonomous agents, i.e. promisors and promises, who publish their intentions to one another in the form of promises (Charness & Dufwenberg, 2006). Carrillo and Dewatripont (Carrillo & Dewatripont, 2008) discussed that a promise can increase the likelihood of voluntary cooperation.

PT defines the promise as a scoped, documented intention that is exposed to another agent. It argues that a set of intentions is much more manageable than actions. In this sense, predictions and decisions are made based on the documented intentions each agent exposes to another. To this end, the conflict of intentions could be detected and resolved before turning into real issues. The theory emphasizes the following principles:

- Locality: avoid impositions, keep things close, and stay responsible.
- Reciprocity: nurture a repeated relationship, think of what drives the economic motor of agent relationships.
- Deal with uncertainties: have multiple contingencies for keeping promises. What will an agent do if a promise it relies on is not kept?

Fig. 1 shows how a promise flows throughout the agents. Agent A2 promises P (note the plus sign), with a promise body consisting of What, Where, When, and How (3W+H), to the agent A1. The agent A1 accepts (the negative sign denotes the acceptance) the promise with the details proposed by the agent A2.

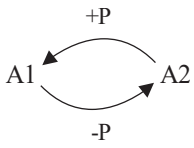

Fig. 1. The relation between agents in view of PT

Although the footprint of PT is meager in the context of management, it has been finding its way into the management arena in recent years. Burgess has introduced new insights into the field of knowledge management (Burgess, 2009). Shadi et al. (Shadi, Afsarmanesh, & Dastani, 2013) proposed a framework based on PT to model and monitor the behavior of agents in virtual organizations.

This research argues that the construction management context has come a long way from the command-control methods (e.g. CPM) to the pull methods (e.g. the LPS); the way is paved for a little more shift in viewpoint with a tendency to make construction environments even more collaborative and self-organized. The PT is likely the lever.

2.1. PT in construction

In traditional construction management methods (e.g. CPM), an obligation-/command-control (OCC) model was prevalent. Planning was done somewhere/sometime far from where/when the actions occurred. In this context, it is not surprising that construction practices deal with unpredicted situations that become increasingly unmanageable, leading to schedule pressure, erroneous outcomes, delays, and budget overruns. In addition, when the number of agents gets large, scalability would be a serious challenge in the case of imperative scripting and remote execution.

In recent years, lean methods revealed that project planning is not as easy as providing a CPM or Gantt chart. Construction projects, due to their complex nature and multiple layers of abstractions, require a novel approach for planning. Contrary to the traditional methods, the LPS suggests (1) approaching the planning to the implementation (in terms of time and space); (2) providing the team members with the opportunity to participate in decision making and planning processes.

In view of PT, the LPS upgrades the construction planning conventions via a number of drivers discussed in section 3. As shown in Fig. 2a, in OCC models, the commands often diverge from one person, i.e. usually the in-charge of the team (e.g. superintendent) to the other agents, whereas in PT model, there is a chain of promises convergent to one agent.

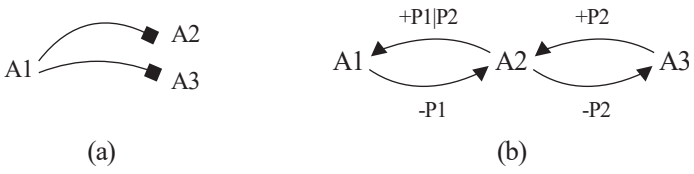

Fig. 2. Task assignment in view of (a) OCC; (b) PT

This paper argues that, at the team level, the LPS follows neither OCC nor PT. It lies

somewhere in between. The manager puts much effort to document the actions in the LPS board (Fig. 3) and assign the tasks to subordinates. Although it is a step forward, in the PT point of view, this is still a sort of managing actions rather than managing intentions.

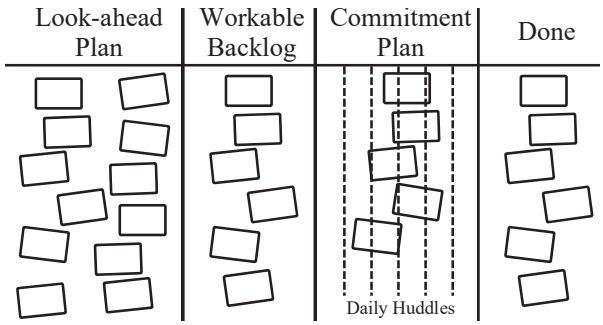

Fig. 3. The LPS board

To be more explicit about how the intentions are documented in the PT model, the following example explicates a scenario of pouring concrete in foundation F1. In this scenario, there are three agents: A1 (superintendent), A2 (concrete worker) and A3 (iron worker) and two promises P1 (pouring concrete) and P2 (reinforcement). The body of each promise is shown in Table 1.

Table 1. the body of promises

Promise	Promisor	Promise	What	Where	When
P1	A2	A1	poured-in concrete	F1	Tuesday
P2	A3	A2	reinforced foundation	F1	Thursday

According to Table 1 and Fig. 2b, the flow of promises is as follows:

1. The iron worker promises a reinforced F1 by Tuesday to the concrete worker (+P2).
2. The concrete worker accepts the iron worker's promise (-P2).
3. The concrete worker promises a poured-in, smoothed-over concrete by Thursday to the superintendent if the iron worker keeps his promise (+P1|P2).
4. The superintendent accepts the concrete worker's promise (-P1)

2.2. LPS in view of PT

At the weekly work plan level, task assignment procedure of the LPS can be justified in a PT way as follows:

1. In weekly meetings, the manager distinguishes the workable tasks, enlists them in "Workable Backlog".
2. The team members, intend to perform the tasks they can do based on their KSA (i.e. Knowledge, Skills, Abilities)
3. Intentions are documented.
4. The conditional intentions are identified and the promise network is formed and documented.

5. Cooperations are formed once the promises are accepted by the promises.

3. PT Drivers

Despite the wealth of recent works on the examination and applications of the LPS in construction project management, little work, if any, has studied the method from the PT point of view. The authors argue that digging into the intricate network of promises, intentions and the agents, helps to better understand and develop the principle of the LPS in particular and pull methods in general. For this, the following attempts to provide an insight into the drivers through which PT can empower LPS to make more difference via decentralization and mapping the set of workable backlogs to a chain of promises.

3.1. Dunbar's limit

(Dunbar, 1992) suggested that there is a cognitive limit to the number of people with whom one can maintain stable social relationships—relationships in which an individual knows who each person is relates to every other person. Moreover, the more intimate relationships, the fewer we can maintain. In this sense, any strategy to reduce the number of connections and/or degrade the quality of connections would be of benefit to the manager. PT, advocates the flow of promises throughout a chain of agents rather than a divergent model of commands handed out by the manager. This shifts the effort from the unnecessary, delegable promises to the most critical ones.

3.2. Working memory

Working memory commonly refers to the cognitive process that enables individuals to maintain and process a limited amount of information at a time (Baddeley, 1992, 1998). Working memory plays a key role in occupational functioning. Although working memory can be rehearsed, it is limited (Cowan, 2010; Hogarth, 1987). The limitation does not allow us to link and process more than 3-5 issues at a time. To this end, delegating promises to subordinates frees up some slots (chunks) of memory for more substantial works.

3.3. Locality

In the conventional pull methods, from PT point of view, the team manager plays the role of a promise dealer. This violates a principle of PT, locality. According to locality, the greater the distance from the point of promise-making, the less causal responsibility an agent has in contributing to the outcome. Simply put, a promise, together with the necessary know-hows to assess and keep the promise, is preferably meant to be entirely localized in a single agent, so all the information required to discover inconsistencies, arising from conflicting promises, is automatically located in one place. In this sense, each agent is, by design, capable of resolving its own inconsistencies without any external help. This is a huge step forward for individual certainty (Burgess, 2015a).

3.4. Bounded rationality

Individuals' rationality in decision making is limited by the tractability of the decision problem, the cognitive limitations of their minds, and the time available to make the decision(Simon, 1972). Putting the PT together with game theoretic models in general and Nash's equilibrium model in particular, as well as the social exchange theory, reveals that cooperation is likely have explanations rooted in bounded rationality: Why should I keep my promises? What will I get out of it? The PT has the prospects to open new insights into modeling and understanding the relation between these themes.

3.5 Scalability

(Tainter, 1988) stated that as groups grow, tendencies would show up as specializing into different roles in order to scale up. However, separation comes at a cost: to get a service from a specialist, it is inevitable to reconnect with them. As agencies separate, they often form their own private languages that are not equilibrated with the general population, so there is a language barrier cost as well; bureaucracy and organizational silos get into the game. Eventually, due to the degradations in trusts, the cost of reconnecting through barriers will raise.

To this end, PT encourages decentralizing the flow of promises throughout the agents (i.e. specialists) that promise to know how to do their job. Decentralization in this manner, eases the bottlenecks that limit the enlargement. Decentralized, flat organizations exhibit scalability with less effort compared to the conventional hierarchical structures(Burgess, 2015b). The flourishing startups are the evidence for such statement. Google, as well, has shown tendencies and even movements towards flat organization structure.

3.6 Self-Determination Theory (SDT)

PT and SDT are both advocate of autonomy. Autonomy is, on the one hand, a presumption of the PT with the notion that "no agent can force any other agent to accept or transmit information, alter its state, or change its behavior. Also no agent may make a promise on behalf of any other"(Burgess, 2005, 2015b). On the other hand, autonomy is a human need from the SDT (Ryan & Deci, 2000).

PT, via encouraging to document the intentions rather than the actions, attempts to formulate outcomes by destination rather than getting deep into processes. In view of the SDT, this promotes the sense of autonomy and motivation among the agents.

4. Conclusions

This paper encourages a new insight into the LPS task assignment procedure from the PT point of view. In this view, decentralization is encouraged in order to promote the scalability and manageability of the team in a self-organized manner. In this sense, the team manager is more of a SCRUM master than of a CPM commander. Such a context has been examined in agile techniques, e.g. SCRUM, with reportedly successful outcomes.

However, applying such a viewpoint to construction management would not seem that easy. An issue that is expected to raise is that “Why they should keep their promises while there is no coercion?”. Elaborate incentive mechanisms are deemed as helpful and necessary in motivating the individuals to keep their promises. The incentives could be contingent on the importance, urgency and the effort needed to keep the promise.

Moreover, establishing such a culture requires top managers to understand the full context of PT and create awareness about the principles of the theory in their subordinates.

Design management, due to the similarity to the IT context, seems promising as a start point for such a change.

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