

RESULTS OF INDICATORS FROM THE LINGUISTIC ACTION PERSPECTIVE IN THE LAST PLANNER® SYSTEM

Luis A. Salazar¹, Fabián Retamal², Glenn Ballard³, Paz Arroyo⁴ and Luis F. Alarcón⁵

ABSTRACT

The correct implementation of the Last Planner® System has been proven to increase the reliability of the planning and performance levels of projects by managing commitments. However, the current management of commitments in weekly planning meetings has not been sufficiently analyzed to teach people how to make reliable promises. Therefore, it is essential to deepen the measurement indicators of the Linguistic Action Perspective to generate reliable commitments that reduce uncertainty and variability in the projects. This study, based on "design science research", shows the first results of the indicators of the fundamental elements of language and action in construction projects in Chile. The results are an improvement over the previous indicators. Previous indicators have only been validated in a classroom setting, whereas this paper presents a validation based on case studies on actual construction projects which carry out weekly meetings using LPS. The authors invite the researchers around the world to measure and compare these indicators.

KEYWORDS

Linguistic Action Perspective, Last Planner® System, Commitments Management, Case Study, Planning meetings.

INTRODUCTION

According to Barbosa et al. (2017), annual productivity of construction has increased 1% per year in the last 20 years, while its spending accounts for 13% of the annual GDP. In order to increase productivity, construction must improve projects' planning and control.

¹ Ph.D. Candidate, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, Researcher – GEPUC, Santiago, Chile, +56 2 2354 7165, lasalaza@uc.cl

² MSc student, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, Researcher – GEPUC, Santiago, Chile, +56 2 2354 7165, faretamal@uc.cl

³ Research Director of the Project Production Systems Lab., Univ. of California, Berkeley, CA 94720-1712, USA, +1 415 710-5531, ballard@ce.berkeley.edu

⁴ DPR Quality Leader, San Francisco, CA, and Adjunct Professor, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, PazA@dpr.com

⁵ Professor, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, Santiago, Chile, +56 2 2354 7165, lalarcon@ing.puc.cl

Ballard (2000) addresses this problem by the introduction of Lean principles in project management by applying the Last Planner® System (LPS). This paper seeks to further improve the planning process by developing and analyzing indicators to measure and ultimately improve the management of commitment in weekly planning on the LPS. This paper is based on Linguistic Action Perspective (LAP) and builds on previous indicators developed by Salazar et al. (2018). This paper proposes the replacement of some of the indicators and adds new ones based on the analysis of several case studies in construction projects. Previous indicators developed by Salazar et al. (2018), were validated in the classroom through the Villego® Simulation, while this paper presents a validation based on case studies on concrete construction projects which carry out weekly meetings using LPS.

LAST PLANNER® SYSTEM AND LINGUISTIC ACTION PERSPECTIVE

The Last Planner® System (LPS) is a methodology to plan and control commitments. Based on the principles of Lean production, LPS seeks to increase the reliability of planning and performance levels (Ballard & Tommelein 2016) and reduce the uncertainty and variability of projects. Through several investigations, the effectiveness of this system has been demonstrated; for example, González et al. (2008) established a direct relationship between the reliability of planning and productivity. Specifically, in Chile, the implementation and study of LPS has generated the incorporation of more actors in the planning process, less variability, more reliable promises and increased productivity (Alarcón et al. 2002). This section explains commitment management in the LPS and Linguistic Action Perspective (LAP).

COMMITMENT MANAGEMENT IN THE LAST PLANNER® SYSTEM (LPS)

According to Koskela & Howell 2002, the implicit theory in traditional project management assumes that the necessary predecessor activities and the resources to execute such activities are always available. However, in practice, this is extremely unlikely. It is assumed that the task is fully understood, initiated and completed according to plan without considering the importance that the worker as the executor must have (Koskela & Howell 2002). Therefore, Howell et al. (2004) propose that LAP improves the effectiveness of LPS.

LINGUISTIC ACTION PERSPECTIVE (LAP)

The Linguistic Action, which was developed by Flores (2015), applies the theory of speech acts of Austin (1971) and Searle (1969) to organizational management. Flores (2015) argues that certain “speech acts” such as promises are themselves actions in the world.

Understanding "conversations for action" as conversations whose purpose is the coordination of diverse actions (Salazar et al. 2018), Flores (2015) proposes a basic and universal structure based on four speech acts. The four speech acts that contain all conversations for action are: 1) request or offer, 2) promise or acceptance, 3) declaration of compliance and 4) declaration of satisfaction.

Flores (2015) defines four stages of a conversation for action, which is called the network or chain of commitments: 1) preparation of a request; 2) negotiation and agreements; 3) execution and declaration of compliance; 4) acceptance and declaration of satisfaction. It is expected that in construction projects, there are variations in the basic movements, such as renegotiation, revoking a previous commitment, or canceling an order. According to Flores (2015), these variations increase the confidence of the commitments.

PRACTICAL PROBLEM BEING ADDRESSED

Although the LPS has made an effort to improve the management of commitments, and Salazar et al. (2018) created indicators to measure the specific elements of the LAP in the LPS, the qualitative analysis has not measured the degree of incorporation of LAP elements in construction projects that use LPS worldwide.

Hence, our proposal is to show the results of the measurement of the indicators of Salazar et al. (2018) and to propose new indicators that complement the work to improve the management of commitments in construction projects.

RESEARCH METHODOLOGY

The research methodology was based on Hevner's "A Three Cycle View of Design Science Research" (2007) and builds on Salazar et al. (2018) previous research. The steps performance are as follows:

1. Study the Linguistic Action Perspective and Last Planner® System to generate a *Knowledge Base* mainly based on Flores (2015) and Ballard (2000).
2. Identify the main elements of the Linguistic Action Perspective that could be quantifiable; create a list of concepts and data to be measured.
3. Develop indicators that could measure and control the main elements of this perspective through the *Design Science Research*.
4. Measure the proposed indicators in four construction projects in Chile to validate them through the *Environment* in a normal construction situation. The researcher recorder, analyzed videotapes of weekly meetings and interviewed participants when necessary to evaluate each commitment for each proposed indicators.
5. Compare the proposed indicators by Salazar et al. (2018), which were validated using Villego® Simulation, and the once proposed in this paper.

INDICATORS: IMPROVEMENT AND NEW PROPOSAL

In this paper, the authors propose a new set of *key performance indicators* (KPIs) measured in the field, which complements the proposed indicators by Salazar et al. (2018). According to the Linguistic Action Perspective, to measure and control the fundamental aspects of the commitments, requests, promises and foundations of trust, these indicators are a useful tool to measure, control and improve the management of commitments in weekly planning meetings, since they provide a quick and specific feedback, which enriches the implementation of the Last Planner® System (Salazar et al. 2018).

To test the KPIs proposed by Salazar et al. (2018) in real projects, measurements were implemented in four construction projects in Santiago, Chile.

The field test led to a series of changes and additions to the original proposal as follows:

1. Proposal to eliminate indicators

- The authors propose not to measure the % verification of the availability of performers in execution because most of the foremen verify the availability of their workers after the weekly meeting and in the field huddle, and these indicators are designed to be measured exclusively in weekly planning meetings.
- We propose to eliminate the % of incomplete requests and promises because it is confusing to measure it in the field.
- Finally, we propose to eliminate the % compliance of the performer's competence because it is associated with the worker's curriculum vitae and it is not possible to measure in the weekly meeting. It can only be associated with the correct fulfillment of each commitment or PPC (Percent Plan Complete).

2. Proposal to change the indicators

- The authors propose modifying the % declaration of the importance of each commitment because they consider it more appropriate to use the word “priority”, so the indicator should be renamed as % declaration of the priority of commitment. This change is proposed because it is necessary to deepen the conditions of satisfaction of the most relevant commitments. See Table 1.
- In addition, the modification of the % reliability compliance is proposed because we found a point of confusion in the formula of the indicator regarding the concept of counteroffers, since counteroffers occur in the same meeting, whereas the concept after the meeting is “renegotiation”. Additionally, "cancel" a commitment is added. See Table 1.

3. Measurement of original indicators

- Table 1 shows the average results of the indicators measured during a month, which incorporate the changes that we mentioned to the proposal by Salazar et al. (2018).

4. New proposed indicators

- The authors propose seven new indicators, which complement the work done by Salazar et al. (2018). See Table 2.

These indicators seek to analyze the management of commitments in weekly planning meetings, so the frequency of measurement is always every 7 days. However, it is necessary to perform at least 2 weekly meetings to analyze the results, according to Salazar et al. (2018).

CASE STUDIES

Regarding the strategy to select the case studies, the "information-oriented selection" was used to establish "extreme cases/deviations" (Flyvbjerg 2006). The units of the analysis were 4 multistory building projects with the LPS implemented with different degrees of maturity, in Santiago, Chile. This number was determined according to the recommendation of Hernández et al. (2014), who recommend a maximum of 8 cases, when

a multiple in-depth study is carried out (Yin 2003), since the study does not represent a "sample", as if an experiment does.

As mentioned, the team used the "information-oriented selection" due to the feasibility of research with companies belonging to the Collaborative Group of the Center of Excellence in Production Management (GEPUC).

RESULTS OF THE INDICATORS

The authors consider it appropriate to analyze the results of each indicator proposed by Salazar et al. (2018), which were measured in 4 construction projects, in the Last Planner meetings.

1. Compliance network or chain of commitments

In general, compliance was observed with the first movement "Preparation of a request" and the third movement "Declaration of compliance", according to the 4 basic movements of conversations for action (Flores 2015). However, there is no negotiation process but only the imposition by the client. For example, the boss says, "it must be ready on Tuesday", and there was no declaration of satisfaction verified, i.e., there was no "Ok" or "Well done". The foregoing shows a lack of knowledge and/or application of LAP in the analyzed projects.

2. Definition of roles and responsibilities

The roles were intrinsically defined, in which there is a clearly established figure for their client and another for the performer. However, the main problem is the scope of the commitments, not being clear the responsibilities of the performers, and what the performer ought to do. For example, the boss asks the enclosure to install the reinforcement in a specific place of the work, but the boss does not specify whether the reinforcement should be purchased, cut, folded and placed, or only placed.

3. Fulfillment of the roles and responsibilities of the performers

What differentiates the construction projects from other projects in regard to the LAP is that, in general, the performer does not make commitments, but instead, the chief performer (foreman) does, except in administrative aspects that the management team commits and executes. Therefore, in construction projects, it does not make much sense to strictly apply rules saying "the performer, and not another, should fulfill the promise and declare compliance to the client", since the foremen are committed on behalf of their workers who perform the work.

4. Declaration of the priority of the commitment

No declaration of priority on the part of the clients was observed, which affected the subsequent planning of the foremen in the field huddle because they did not execute the commitments in the correct order. One of the events that confirmed the importance of this indicator occurred in a meeting of review of commitments; the planner (client) reprimanded the foreman (performer) because he had performed 9/10 activities (90%), but the only activity he did not do "was the most important thing", and therefore, the foreman was "incompetent" and "not reliable".

TABLE 1. Measurement of the KPI Linguistic Action Perspective in the Last Planner® System (proposed by Salazar et al. 2018)

Objective	Measure Name	Description	Formula	Results	General Comments
Measurement and Control of Promises and Petitions	% compliance network or chain of commitments	KPI measures the percentage of compliance with the chain of commitments; that is to say, that the 4 movements for the coordination are fulfilled	$(\text{Number of commitments in which the 4 movements for coordination are fulfilled}) / (\text{Total number of commitments}) \times 100$	0%	* The preparation of the petition is observed * There is no negotiation process, but rather an imposition by the client * The declaration of compliance is verified * The declaration of satisfaction is not observed
	% definition of roles and responsibilities of the performers	KPI measures the percentage of commitments that define roles and responsibilities of performers	$(\text{Number of commitments with defined roles and responsibilities}) / (\text{Total number of commitments}) \times 100$	83%	* In general, roles are defined intrinsically: client requests and performers agrees. Regarding responsibilities, the scope of the commitment is not always clearly established
	% fulfillment of roles and responsibilities of performers	KPI measures the percentage of commitments in which the roles and responsibilities of previously defined performers are met	$(\text{Number of commitments that fulfilled previously defined roles and responsibilities}) / (\text{Total number of completed commitments}) \times 100$	15%	* In general, in the construction works the performer does not commit, the one who commits is the head of the performer (foreman) * Performer is engaged in administrative aspects (management team)
	% declaration of the priority of commitment	KPI measures the percentage of commitments that declare the importance (priority) of this, explicitly	$(\text{Number of commitments declaring importance}) / (\text{Total number of commitments}) \times 100$	10%	* In general, the priority of the commitments is not declared. This does not allow the foremen to carry out an adequate planning regarding the execution order of the assumed commitments
	% compliance with priority commitments	KPI measures the percentage of commitments that were declared priority and that are effectively met	$(\text{Number of priority commitments fulfilled}) / (\text{Total number of priority commitments}) \times 100$	100%	* The few commitments that were declared a priority were completed. The foregoing demonstrates the importance of making the priority statement
Measurement and Control of Fundamentals of Trust	% verification of availability of performers in agreements	KPI measures the percentage of commitments that verify the availability of performers in the negotiation stage and agreements	$(\text{Number of commitments that verify availability of performers in agreements}) / (\text{Total number of commitments}) \times 100$	18%	* There is a low percentage of verification of the availability of performers in the stage of negotiation and agreements
	% specify the deadline	KPI measures the percentage of commitments that specify the deadline	$(\text{Number of commitments that specify the deadline}) / (\text{Total number of commitments}) \times 100$	10%	* In general, only the date is specified, but it is not detailed schedule, or if it will be completed in the morning or in the afternoon
	% of unnecessary requests	KPI measures the percentage of commitments that make unnecessary requests	$(\text{Number of commitments that make unnecessary requests}) / (\text{Total number of commitments}) \times 100$	3%	* Low percentage in weekly meetings * According to the workers, the foremen often make unnecessary requests on the field
Measurement and Control of Fundamentals of Trust	% reliability compliance (* complementary to PPC)	KPI measures the percentage of commitments where the performer is able to perform reliably and timely in the required domain	$(\text{Number of commitments fulfilled} + \text{number of commitments revoked} + \text{number of renegotiations} + \text{number of commitments canceled}) / (\text{Total number of commitments}) \times 100$	81%	* It must always be a percentage equal to or greater than the PPC * Complements the PPC with additional movements, which happen after the initial agreement
	% Engaged participants	KPI measures the percentage of meeting participants who are engaged to it	$(\text{Number of participants engaged to the meeting}) / (\text{Total number of attendees}) \times 100$	48%	* High degree of participation (only 10% left the meeting) * No meeting started at the agreed time * A lot of interaction with the cell phone during the meeting (calls, chat and e-mail) * Interruptions by radio * Some moments spoke two or more people at the same time * 60% of the team takes note (everyone should take note) * Non-verbal language indicates fatigue and lack of attention

Source: Own elaboration, based on (Salazar et al. 2018)

TABLE 2. Measurement of the newly proposed KPI from the Linguistic Action Perspective in the Last Planner® System

Objective	Measure Name	Description	Formula	Results	General Comments
Measurement and Control of Commitments	% fulfillment of a request	KPI measures the compliance percentage of the first movement; preparation of a request by the client	(Number of commitments in which the petition is prepared) / (Total number of commitments) x 100	100%	* Client is clear about the request (what) and to whom it will be entrusted (performer)
	% compliance negotiation and agreements	KPI measures the compliance percentage of the second movement; negotiation and agreements	(Number of commitments in which a negotiation and agreement is made) / (Total number of commitments) x 100	20%	* In general, there is no negotiation before the agreement. The performer assumes the order established by the client. Sometimes he does not answer if he can or does not comply with the agreement
	% declaration of compliance with the commitment	KPI measures the percentage compliance of the third movement; execution and declaration of compliance with the commitment by the performer	(Number of commitments in which compliance is declared) / (Total number of commitments completed) x 100	78%	* It is verified by questions to clients and performers before the weekly meeting that there is a high percentage of declarations of compliance with the commitments. However, there are performers who do not inform clients that they finished with the assigned task
	% fulfillment declaration of satisfaction	KPI measures the percentage of compliance of the fourth movement; acceptance and declaration of satisfaction by the client	(Number of commitments in which satisfaction is accepted and declared) / (Total number of commitments completed) x 100	5%	* There is a low percentage of commitments in which satisfaction is declared by the client. In general, it is only indicated if the commitment is fulfilled or not, without giving feedback to the performer
Measurement and Control of Fundamentals of Trust	% revoked commitments	KPI measures the percentage of commitments revoked	(Number of commitments revoked) / (Total number of commitments) x 100	4%	* Minor percentage of commitments are revoked after the weekly meeting
	% renegotiated commitments	KPI measures the percentage of renegotiated commitments	(Number of renegotiated commitments) / (Total number of commitments) x 100	2%	* Practically no renegotiation of commitments after the weekly meeting
	% canceled commitments	KPI measures the percentage of canceled commitments	(Number of canceled commitments) / (Total number of commitments) x 100	1%	* Practically no cancellation of commitments after the weekly meeting

Source: Own elaboration

5. Compliance with priority commitments

The commitments that were declared as priorities by the clients were completed in time by the foremen. The foregoing demonstrates the importance of prioritizing commitments and not leaving this responsibility to foremen.

6. Verification of availability of performers in agreements

In general, there was no verification of the availability of workers by the foremen. Therefore, the foremen don't arrive at the meeting with their agenda and the agenda of their work teams.

7. Specify the deadline

It was mandatory that a specific day but not an hour was established as a deadline. Thus, we recommend establishing at least one AM or PM schedule to obtain more specific planning.

8. Unnecessary requests

There was a smaller number of unnecessary requests in the weekly meetings but a high percentage in the field huddle, as mentioned by the workers.

9. Reliability compliance

This indicator seeks to complement the PPC according to the 3 additional movements that occurred after the weekly planning meeting. The authors work on establishing the appropriate deadline (last responsible moment) to renegotiate, revoke and cancel a commitment, without affecting the planning of the project. The difference between canceling and revoking, is the person performing the action; in a cancellation, the client breaks the commitment, whereas in a revocation, the performer cannot comply.

10. Engaged participants

This indicator seeks to measure the engagement of the participants in the meeting, according to the following checklist: if the person arrives within the hour or in the afternoon, interacts with a cell phone, leaves the room, interacts with a walkie talkie, intervenes in the meeting, takes notes or looks at the person he is talking to.

RESULTS OF THE NEW INDICATORS

The result of each new indicator is explained below:

1. Fulfillment of a request

The client was clear about the request and who would be responsible for it; it is an intrinsic part of the Last Planner® System. For the above, the indicator was 100% satisfactory.

2. Compliance negotiation and agreements

The performer assumed the order established by the client and has no negotiation process, as such. Many times, the performer did not even answer affirmatively, and the establishment of the commitment was assumed.

3. Declaration of compliance with the commitment

The performer should have fulfilled the task entrusted and have made the declaration of compliance immediately, before the weekly meeting so that clients could verify the commitment and give the corresponding declaration of satisfaction. However, there was a significant percentage of performers who waited until the weekly meeting to report that they fulfilled the previously agreed commitment.

4. Fulfillment declaration of satisfaction

In general, this declaration only indicates whether the commitment is fulfilled without providing feedback to the performer regarding the conditions of satisfaction, how to improve in a next installment or any appreciation for the work done.

5. Revoked commitments

The revoked commitments are those in which the performer informs the client after the meeting that he will not be able to fulfill the required commitment. The main problem detected is that the foremen, despite knowing that their team could not fulfill the

commitment, did not inform the client in time. The applicable rule is that the moment a performer becomes uncertain that he can keep a promise, he must inform the ‘client’ (requestor) and the entire team.

6. Renegotiated commitments

The renegotiated commitments are those in which the performer (or client) wishes to change the conditions of satisfaction after the meeting to generate a new negotiation. One of the detected problems is that most of the foremen attempted to comply with the % of work requested, but did not renegotiate a lower % or an alternative task.

7. Canceled commitments

The canceled commitments are those in which the client informs the performer after the meeting that the acquired commitment is no longer necessary. Although this situation is unlikely to occur, the planners must know that they can cancel a commitment and request another one after the meeting (renegotiation).

CONCLUSIONS

The study in this paper shows the application of the Linguistic Action Perspective (Flores 2015) in four construction projects and updates the study conducted by Salazar et al. (2018) by proposing improvements and creating new indicators for the measurement and control of the management of commitments in construction projects. To validate these measurements, contractors who participated in in Last Planner® System meeting were consulted about their perceptions, they stated that these measurements improved the ability to provide reliable promises, since they understood the importance of speech acts, satisfaction conditions and trust in the management of commitments.

Therefore, the entire community linked to the construction industry is invited to use the proposed indicators to compare with the “location dimension” (Flyvbjerg 2006). The differences and similarities among different projects around the world, with the objective of determining the effect of the culture of the people and organization in the management of commitments and the general performance of construction projects.

Also, in future studies, the authors propose to apply case studies in weekly planning meetings in other industries worldwide and to determine the recommended values to improve communication and achieve the proper implementation of LAP in LPS.

Finally, the authors consider that this second generation of key performance indicators measured in the field (eliminating, changing and proposing the KPI from the first generation) generate a powerful tool to measure, control and improve the management of commitments in weekly planning meetings, since they enable quick feedback that undoubtedly enriches the Last Planner® System.

ACKNOWLEDGMENTS

We thank GEPUC and GEPRO for their support in this research. Finally, Luis A. Salazar acknowledges the financial support for his Ph.D. studies from the Scholarship Programme of Conicyt Chile (CONICYT-PCHA/Doctorado Nacional/2016-21160819).

REFERENCES

- Alarcón, L. F., Diethelm, S., and Rojo, Ó. (2002). “Collaborative implementation of lean planning systems in Chilean construction companies.” *10th Annual Conference of the International Group for Lean Construction*, Gramado, Brazil.
- Austin, J. L. (1971). *Palabras y Acciones*. Paidós, Buenos Aires.
- Ballard, G., and Tommelein, I. (2016). “Current Process Benchmark for the Last Planner(R) System.” *Lean Construction Journal*, 89, 57–89.
- Ballard, H. G. (2000). “The Last Planner System of Production Control.” The University of Birmingham.
- Barbosa, F., Woetzel, J., Mischke, J., Ribeirinho, M. J., Sridhar, M., Parsons, M., Bertram, N., and Brown, S. (2017). *Reinventing construction through a productivity revolution*.
- Flores, F. (2015). *Conversaciones para la Acción: Inculcando una cultura de compromiso en nuestras relaciones de trabajo*. Lemoine Editores.
- Flyvbjerg, B. (2006). “Five Misunderstandings About Case-Study Research.” *Qualitative Inquiry*, 12(2), 219–245.
- González, V., Alarcón, L. F., and Mundaca, F. (2008). “Investigating the relationship between planning reliability and project performance.” *Production Planning & Control*, 19(5), 461–474.
- Hernández, R., Fernández, C., and Baptista, P. (2014). *Metodología de la investigación*. Mc Graw Hill Education, México D.F.
- Hevner, A. R. (2007). “A Three Cycle View of Design Science Research.” *Scandinavian Journal of Information Systems*, 19(192), 87–92.
- Howell, G. A., Macomber, H., Koskela, L., and Draper, J. (2004). “Leadership and Project Management: Time for a Shift from Fayol to Flores.” *12th Annual Conference of the International Group for Lean Construction*, S. Bertelsen and C. T. Formoso, eds., Helsingør, Denmark.
- Koskela, L., and Howell, G. A. (2002). “The underlying theory of project management is obsolete.” *Proceedings of the PMI Research Conference*, 293–302.
- Salazar, L. A., Ballard, G., Arroyo, P., and Alarcón, L. F. (2018). “Indicators for Observing Elements of Linguistic Action Perspective in Last Planner® System.” *Proc. 26th Annual Conference of the International Group for Lean Construction (IGLC)*, V. A. González, ed., Chennai, India, 402–411.
- Searle, J. R. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge university press.
- Yin, R. K. (2003). “Investigación sobre estudio de casos. Diseño y métodos.” 1–35.