

RESULTS OF KEY INDICATORS FROM LINGUISTIC ACTION PERSPECTIVE IN PANDEMIC: CASE STUDY

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ABSTRACT

Due to the low productivity of the construction sector and current global pandemic conditions, it is essential to analyze interpersonal relationships at work, engagement and labour productivity, through the management of commitments. Therefore, this article seeks to measure and analyze key Linguistic Action Perspective (LAP) indicators to examine commitment management in Last Planner® System (LPS) weekly work planning meetings during the pandemic (virtual and face-to-face meetings). The case of study methodology was used in 27 projects of a construction company in Colombia, in which the authors analyzed the results of LAP engagement indicators and compared them to the PPC, determining Spearman's correlation coefficient in each indicator and finding that the projects that had strong correlations were those where: the percentage of progress was between 65% and 95%; average PPC was between 60% and 90%; a "Big Room" was used; and the meetings had between 10 and 20 attendees. For future research, we propose the use of other methods of relationship, causation and/or prediction analysis, such as Structural Equation Models or Machine Learning, a future methodology for virtual or semi-face-to-face meetings and the study of other performance indicators.

KEYWORDS

Linguistic action perspective, pandemic, case Study, Last Planner® System.

INTRODUCTION

CONTEXT

Several studies have shown that Lean practices manage to reduce construction times and cost, energy consumption and particulate matter; as well as improving conditions of safety, occupational health and interpersonal relationships (Ahuja 2013; Bajjou et al. 2017; Belayutham et al. 2017; de Carvalho et al. 2017; Ogunbiyi et al. 2014; Salgin et al. 2016; Verrier et al. 2016; Weinheimer 2016; Weinheimer et al. 2017). However, most of the research conducted has focused on reducing tangible waste, leaving in a secondary

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place the reduction of waste from intangible resources that are mainly caused by inadequate planning practices (Hamzeh et al. 2019).

Therefore, Last Planner® System (LPS) has focused its efforts on increasing planning reliability and performance levels (Ballard and Tommelein 2016). Because of this, it is essential to achieve adequate commitment management at weekly planning meetings, as coordinated action is required through a complex network of request and promises (Ballard and Tommelein 2016). For this reason, Howell et al. (2004) propose Linguistic Action Perspective (LAP) developed by Flores (2015). LAP is based on four stages, which form the network of commitments: 1) preparation of a request; 2) negotiation and agreements; 3) execution and declaration of compliance; and 4) acceptance and declaration of satisfaction (Salazar et al. 2018). To properly measure and control commitment management, Salazar et al. (2020) propose a LAP Indicator System, through the Design Science Research (DSR) methodology.

STATE OF THE ART AND PRACTICE

When reviewing the Web of Science database, the authors found four articles regarding “Linguistic Action Perspective” or “Language Action” in construction projects (Isatto et al. 2015; Salazar et al. 2020; Viana et al. 2017; Zegarra and Alarcon 2017). However, from these studies, including the countless IGLC publications (Howell et al. 2004; Long and Arroyo 2018; Viana et al. 2011; Zegarra and Alarcón 2013), there is only one proposal for LAP indicators (Salazar et al. 2018, 2019, 2020), but it does not explain the relationship between how these commitments are established and the outcome. In addition, only partial results of the relationship between some LAP indicators, Percentage Plan Completed (PPC) and Social Networks are shown in the publication of Retamal et al. (2020). Therefore, the publication of this case study in the pandemic, will show the measurement and control of commitments indicators in planning meetings focusing on team engagement for the first time.

NEED AND RELEVANCE OF RESEARCH

According to the above, we found a shortage of studies detailing how LPS directly affects constructions projects, since most authors propose indicators and they show the results, but do not explain how they achieved those results. Adding the particular situation we are currently living with the pandemic, we consider it essential to focus on interpersonal relationships at work, engagement and labour productivity, measuring and controlling the indicators proposed by Salazar et al. (2020) about LAP as a complement to LPS. This due to the fact that the greatest amount of effort has been made in reducing waste from tangible materials, neglecting waste from intangible resources and human behavior (Hamzeh et al. 2019). The latter is of vital importance because the core of Lean Construction is the people (Li et al. 2020).

For all of the above, our purpose is to measure and analyze key LAP indicators to review commitment management at weekly LPS meeting during the pandemic (virtual and face-to-face meetings), particularly the “Engagement” indicators proposed by Salazar et al. (2020). For this reason, we focus our study especially in the first two stages from the network or chain of commitments: preparation of a request, and negotiation and agreements. Both of them are carried out in the LPS weekly planning meetings in which we consider that the repetitive behaviors of the participants could affect a correct commitment management. We consider it to be a new knowledge, as these indicators are recent and have not been evaluated to date in a case study. So, we believe that measuring

the engagement of last planners during weekly planning will be a contribution to the state of art and practice.

RESEARCH METHOD

The authors adopted the case study methodology because it allows in-depth and multifaceted scans of complex problems in a real environment (Yin 2003). This methodology applies when research addresses descriptive or explanatory questions: for example, what happened, how and why?, when the researcher has little control over events and when the phenomenon is contemporary (Yin 2003).

This research was developed in a construction company out of which 27 residential building projects were evaluated in different regions of Colombia, during the months of September to November 2020. Our goal was to analyze the results of LAP indicators and compare them with the PPC to determine whether there was a relationship between human behaviour in meetings (or trusted environment), reliability of commitments and labor productivity.

We selected this company because it has been using LPS for several years, outsourcing much of the construction activities (more actors are involved during the process) and because of its willingness and intention to participate in this research and adopt new tools that allow it to improve the management of commitments in its projects. By 2019, the company had an LPS implementation level of 76% and made use of tools such as: Master planning; Phase planning; Lookahead planning with Percent of Constraint Removal (PCR); Weekly work planning with Percent Plan Completed (PPC); Visual management; and Causes of non-compliance analysis.

Recently and as part of a pandemic labour reactivation strategy, the company began to make use of the “Engagement” indicators proposed by Salazar et al. (2020), in order to control and improve interpersonal relationships at work and engagement during weekly work planning meetings.

RESULTS OBTAINED

For each of the projects studied, we recollected and summarized the following information (**¡Error! No se encuentra el origen de la referencia.**): number of meeting attendees, percentage of non-attendees, percentage of progress of each project, duration of the meeting, number of weeks of information collection, average PPC, average scheduled activities, and meeting place. This data collection was needed in order to be able to perform the analysis of the results and to have a more in-depth understanding of the differences between projects.

Then, we performed a correlation analysis between the LAP indicators of “Engagement” and the PPC based on Spearman’s correlation coefficient or Spearman’s Rho. This coefficient evaluates the monotonous relationship between two continuous or ordinal variables and determines their statistical dependence by comparing the ranges and order numbers of each variable (Moreno 2008). It is a non-parametric linear association measure that, unlike Pearson’s correlation coefficient, allows to take into account outliers that would otherwise affect its calculation in the Pearson coefficient (Moreno 2008). This coefficient is used when the data does not meet the parametric statistic assumptions required to use the Pearson coefficient (Moreno 2008).

Considering that the LAP indicators of “Engagement” measure human behaviors and attitudes, Spearman’s chosen coefficient interpretation scale is a proposal by Dancey &

Reidy for the area of psychology (Akoglu 2018). For this specific case, a correlation value of 1 means that as there is an increase in the number of people following any of the behaviors studied, the PPC also increases. A value of -1 indicates that an inverse relationship between the behaviors and the PPC is observed.

Table 1. Summary of Project Data and Conditions

Project	Number of assistants	Percentage of absence	Percentage of advance	Time (min)	Weeks	PPC average	Scheduled activities average by week	Meeting place
P1	14	6,95%	50,00%	85	7	61,81%	36	Container
P2	14	38,01%	80,00%	75	10	54,33%	56	Workplace dining room
P3	22	17,74%	59,00%	82	10	58,45%	115	Container
P4	15	13,84%	54,00%	53	12	86,15%	60	Parking
P5	16	6,63%	48,00%	146	9	56,62%	81	Container
P6	11	29,27%	50,00%	61	11	53,22%	150	Communal living
P7	16	3,72%	52,00%	59	10	89,86%	49	Parking
P8	15	10,61%	24,00%	126	10	78,01%	51	Next to container
P9	12	19,23%	52,00%	69	11	80,72%	31	Communal living
P10	19	10,10%	69,00%	56	11	82,60%	36	Workplace dining room
P11	15	21,00%	73,00%	66	11	77,58%	29	Next to container
P12	11	9,26%	9,00%	47	9	78,09%	18	Construction camp
P13	26	9,18%	65,00%	98	12	72,46%	46	Workplace dining room
P14	13	0,61%	38,00%	99	11	76,89%	48	Container
P15	14	23,03%	68,00%	131	9	66,99%	54	Boardroom
P16	11	27,27%	77,00%	82	10	71,67%	23	Workplace dining room
P17	15	3,13%	18,00%	134	11	57,20%	44	Container
P18	16	3,06%	45,00%	74	10	75,54%	77	Workplace dining room
P19	19	17,10%	54,00%	80	12	63,40%	90	Boardroom
P20	10	10,03%	59,00%	93	9	39,26%	125	Parking/Communal living
P21	7	63,39%	96,00%	31	10	51,93%	40	(Virtual)
P22	16	8,96%	32,00%	67	10	80,60%	39	Workplace dining room
P23	8	9,72%	12,00%	48	10	76,36%	12	Container
P24	15	5,26%	70,00%	174	9	64,45%	57	Container
P25	13	34,58%	47,00%	77	11	65,83%	55	Construction camp
P26	10	16,79%	87,00%	48	11	77,60%	42	Next to container
P27	17	8,05%	40,00%	67	12	60,12%	53	Boardroom

Table 2 shows the results of this analysis, where we selected only correlations with significance level of less than 0.1. Values in green refer to strong and moderate negative correlations (which means that the lack of engagement of the participants in LPS weekly plan meetings is inversely related to the PPC) and values in red refer to strong and moderate positive correlations (meaning that the engagement of participants in LPS weekly plan meetings is directly related to the PPC).

Additionally, Table 3 displays the frequency (the number of projects where the behavior is repeated) and force summary with which correlations appear in all projects. For example, the value between the Strong-Negative line and column E2 describes the fact that we found a strong inverse correlation between the indicator E2 (Checks cell phone) and the PPC in 8 different projects.

Table 2. Correlations between Engagement and PPC

Project	Person is late E1	Checks cell phone E2	Cell phone rings E3	Talks on the cell phone E4	Leaves the room E5	Walkie-talkie sounds E6	Talks on walkie-talkie E7	Does not speak E8	Does not take notes E9	Does not look at the person who is speaking E10
P1	-0,90									
P2										
P3		-0,76			-0,74					
P4		-0,65								
P5	-0,84								0,66	
P6	0,63	0,84		0,72					-0,82	
P7		-0,66	-0,63	-0,76	-0,87					
P8			-0,79	-0,75					-0,98	
P9		-0,72			0,77					
P10			0,63	0,55						
P11	-0,65								-0,73	
P12			-0,77	-0,77						
P13		-0,79						-0,68	-0,75	
P14		-0,79								
P15		-0,79		-0,73	-0,69					
P16			-0,69	-0,77						
P17		-0,63	-0,79							
P18		-0,81		-0,54	-0,50					
P19		-0,74								
P20		0,77	0,75						-0,85	0,74
P21	-0,68									
P22										
P23										
P24	0,85	-0,92			0,85				0,95	
P25									-0,70	
P26		-0,65							-0,67	
P27			-0,69							

Table 3. Frequency and Strength of Correlations between Engagement and PPC

Correlations		Person is late	Checks cell phone	Cell phone rings	Talks on the cell phone	Leaves the room	Walkie-talkie sounds	Talks on walkie-talkie	Does not speak	Does not take notes	Does not look at the person who is speaking	SubTotal	Total
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10		
		Negative	Strong <-0,7	2	8	3	5	2	0	0	0		
Moderate (-0,4;-0,7)	1	4	3	1	2	0	0	1	2	0	14		
Weak (-0,4;-0,1)	0	0	0	0	0	0	0	0	0	0	0		
None (0;-0,1)	0	0	0	0	0	0	0	0	0	0	0		
Positive	Strong <0,7	1	2	1	1	2	0	0	0	1	2	10	13
Moderate (0,4;0,7)	1	0	1	1	0	0	0	0	0	0	3		
Weak (0,1;0,4)	0	0	0	0	0	0	0	0	0	0	0		
None (0;0,1)	0	0	0	0	0	0	0	0	0	0	0		

ANALYSIS AND DISCUSSION

After analyzing the results and conditions of each Project, we discovered that depending on the specific characteristics of these, we obtained different levels of correlations between LAP and PPC “Engagement” indicators. Within the characteristics that generated weak correlations, we found projects where: No attendances were high (usually greater than 20%); average project PPC of less than 50%; PPC close to or greater than 90% (specific case of P7 where in 10 of 11 weeks the PPC was between 87% and 96%, but the average was below 90% for a specific week); meetings lasting more than 2 hours; meetings with 10 or fewer attendees; and finally, the percentage of progress was lower than 15% and above 95% in some cases.

On the other hand, the projects that had strong correlations were those where: the percentage of progress was between 65% and 95%; average PPC was between 60% and 90%; a “Big Room” was used, and the meetings had between 10 and 20 attendees.

It is important to mention that in long-term meeting, maintaining the concentration of attendees becomes more difficult (Romney et al. 2019), so managing time is key. Therefore, we note that factors such as the size and progress of the project, number of commitments, number of attendees (number of subcontractors) and the discussion of technical aspects, affected the duration.

By deepening our analysis, we found that the indicators that had strong correlations most often are those that are related to cell phone use: “Checks cell phone”, “Cell phone rings” and “Talks on the cell phone”. This is consistent with previous claims that the cell phone can negatively affect labor productivity (Malan 2019; Thornton et al. 2014). Although within the protocols of the construction company it is forbidden to use the cell phone, it was very complex to avoid its use because the participants argued that it was their working tool. We believe that its use should be avoided, since while the cell phone may be useful in a working context, social media is a factor of distraction and deconcentration. Moreover, we observed that the “Leaves the room” indicator in almost all cases, was related to going out to answer the cell phone.

On the other hand, the “Does not take notes” indicator is the second most frequent strong correlation between indicators. Although it should not be necessary to take notes if and LPS board is used, we noted that those responsible did not always go to check the tasks fulfilled and missing during the week. However, we believe that this indicator is complementary to the board and minutes of the meeting, particularly in this case study, the result obtained may be due to the outdoor and stand-up meeting in some projects, which made it difficult for attendees to take notes.

Although some of the “Engagement” indicators had lower frequency in correlations, this does not necessarily mean that they are not related to the reliability of commitments and labour productivity. For example, in the case of the “Person is late” indicator, we noted that punctuality is an important factor in the reliability of commitments and even the same people with the Project, as there is a lack of commitment to the meeting, colleagues and the project (when someone is constantly late). In this specific case, we believe that it has no direct relationship with the PPC because in the context of the Works studied, the star of the meeting was delayed until there were an acceptable number of people to begin the meeting.

Likewise, according to the ideal operation of LPS in planning meetings, each last planner should say what they committed to do last week, what they did last week, why commitments were not met, what they should and can do this week and what they need from others to carry out their tasks. In this way, everyone must participate in the meeting

and it would not be necessary to measure the indicator “Does not participate in the meeting”. But in each company and even in each work LPS is adapted according to the magnitude of the work, number of contractors and time limits for meetings.

In the case of the construction company studied, in the programming phase of weekly activities, all subcontractors had to intervene by saying aloud which activities they were committing to perform by locating the post-it on the LPS board. But sometimes more people from those indicated or people without decision-making power within their company attended, so they did not intervene. Faced with this situation, we consider that the only way to know if someone “does not add value to the meeting” is with this indicator, as no last planner should be missing or left over.

We consider that the “Walkie-talkie sounds” and “Talks on Walkie-talkie” indicators are no longer relevant as they have generally been replaced by the cell phone. In addition, the “Does not look at the person who is speaking” indicator can be a Good indicator of how many people actually pay attention, although it was very complex to measure it by the facilitator (professional assigned by the builder to measure the indicators)

On the other hand, as the data were taken during the global health crisis due to the pandemic, the results could be affected by changes in projects due to bio-security protocols, including:

Open-pit meetings: here distraction is easier because of the noise itself that is generated in projects, where people take advantage to answer the phone, talk to each other, solve doubts. In addition, there are workers who pass through the meeting place or come to make some request, among others.

Stand-up meetings: it makes it uncomfortable to stand still (distractions are sought and notes are difficult to take).

Virtual or semi-face-to-face meeting: in these cases, it becomes more difficult to control the meeting and evaluate the indicators of commitments used. Indicators such as punctuality and checking the cell phone lose meaning because people can enter the meeting without even being in front of the screen. In these meetings, usually those who end up leading are the heads of work and the structure of the meetings changes: usually a single person speaks, dictating one by one the commitments and asking others whether they agree or not, LPS board is not used.

Physical distance between people: it makes it difficult to hear by distance.

Outdoor LPS board: as it is usually completed with post-it, some of them may be taken off by wind, losing the traceability of some commitments.

In short terms, we were able to see that the indicators of “Engagement”, when measuring human behaviors, varied due to working conditions in pandemic and influenced compliance and correct management of commitments.

RESEARCH LIMITATIONS

In this case of study, LAP’s “Engagement” indicators were compared only to the PPC, as it is the most widely used and most representative indicator of LPS, but they could be compared to other project performance indicators such as yields and cost. Additionally, correlation analysis is a method that allows you to identify the relationships between two variables but does not necessarily represent a causality between them, which is why an in-depth analysis is required to determine causalities. So other methods of analysis should be considered, such as Structural Equation Models (SEM), which allows the study of causal relationships between directly observable data. Similarly, an analysis from

Machine Learning could be performed because it could determine behavior patterns and thus create predictive systems.

Moreover, considering the relationships identified in this study, it might be valuable to develop a methodology based on LAP for meetings and work in a virtual environment, as well as to analyze the impact of the use of social networks on construction projects.

Finally, the scope of the research only considered high-rise construction projects in Colombia in Pandemic times and with low to medium LPS implementation levels. In addition, the authors only analyzed the data, as these were collected by facilitators (professional assigned by the builder to measure the indicators) of the construction company, which can certainly affect the reliability and variability of the results.

CONCLUSIONS

This paper shows a case of study where LAP “Engagement” indicators were measured and analyzed in a real context, pandemic construction projects. The authors conducted a correlation analysis between these indicators and the PPC, finding that there is an important relationship between cell phone use and note-taking at weekly planning meetings and the PPC. In addition, we identified that relationships are stronger and appear more frequently when the project progress rate is between 65% and 95%; the average PPC is between 60% and 90% or nearby values; meetings are held in enclosed spaces and have 10 to 20 attendees. Other indicators in which we expected to have a high correlation such as “person is late”, we think had little relation to the PPC due to specific factors in this study, such as difficulty in measurement, relevance in the actual context of the project (use of indicators without monitoring and expert accompaniment) and changes in working conditions due to the pandemic. Given the relationships found we can say that the use, control and traceability of LAP “Engagement” indicators in the post-pandemic context are extremely useful to improve the management of commitments and with it, the application of LPS construction projects. So, research certainly represents a new knowledge and contribution to the state of art and practice in LPS, not only in a post-pandemic context, but also because indicators measure aspects of the behavior of construction workers that have been under-studied to date. However, we also found long-term barriers to research due to data reliability and variability, number of projects, weeks studied and the use of PPC as the sole indicator of comparison. Finally, for future research we propose the use of other methods of relationship, causality and/or prediction analysis such as SEM or Machine Learning, a future methodology for virtual or semi-face-to-face meetings and the study of other performance indicators.

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REFERENCES

- Ahuja, R. (2013). “Sustainable construction: Is lean green?” *ICSDEC 2012: Developing the Frontier of Sustainable Design, Engineering, and Construction - Proceedings of the 2012 International Conference on Sustainable Design and Construction*, 903–911.
- Akoglu, H. (2018). “User’s guide to correlation coefficients.” *Turkish Journal of*

- Emergency Medicine*, 18(3), 91–93.
- Bajjou, M. S., Chafi, A., Ennadi, A., and El Hammoumi, M. (2017). “The practical relationships between lean construction tools and sustainable development: A literature review.” *Journal of Engineering Science and Technology Review*, 10(4), 170–177.
- Ballard, G., and Tommelein, I. (2016). “Current Process Benchmark for the Last Planner System.” *Lean Construction Journal*, 13(1), 57–89.
- Belayutham, S., González, V. A., and Yiu, T. W. (2017). “Lean-based clean earthworks operation.” *Journal of Cleaner Production*, 142, 2195–2208.
- de Carvalho, A., Granja, A., and da Silva, V. (2017). “A Systematic Literature Review on Integrative Lean and Sustainability Synergies over a Building’s Lifecycle.” *Sustainability*, Multidisciplinary Digital Publishing Institute, 9(7), 1156.
- Flores, F. (2015). *Conversaciones para la Acción: Inculcando una cultura de compromiso en nuestras relaciones de trabajo (Conversations For Action and Collected Essays: Instilling a Culture of Commitment in Working Relationships)*. (M. Flores, ed.), Lemoine Editores, Bogotá, Colombia.
- Hamzeh, F., Al Hattab, M., Rizk, L., El Samad, G., and Emdanat, S. (2019). “Developing new metrics to evaluate the performance of capacity planning towards sustainable construction.” *Journal of Cleaner Production*, Elsevier Ltd, 225, 868–882.
- 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.
- Isatto, E. L., Azambuja, M., and Formoso, C. T. (2015). “The Role of Commitments in the Management of Construction Make-to-Order Supply Chains.” *Journal of Management in Engineering*, ASCE, 1801 Alexander Bell Dr, Reston, VA 20191-4400 USA, 31(4), 04014053.
- Li, S., Fang, Y., and Wu, X. (2020). “A systematic review of lean construction in Mainland China.” *Journal of Cleaner Production*, Elsevier Ltd, 257, 120581.
- Long, D., and Arroyo, P. (2018). “Language, moods, and improving project performance.” *Proc. 26th Annual Conference of the International Group for Lean Construction (IGLC)*, V. González, ed., Chennai, India, 495–504.
- Malan, J. (2019). “The Influence of Digital Distraction on cognitive load, attention conflict and meeting productivity.” *Thesis*, University of Cape Town.
- Moreno, E. (2008). *Manual de Uso de SPSS. Universidad Nacional de Educación a Distancia*, Madrid, España.
- Ogunbiyi, O., Oladapo, A., and Goulding, J. (2014). “An empirical study of the impact of lean construction techniques on sustainable construction in the UK.” *Construction Innovation*, 14(1), 88–107.
- Retamal, F., Salazar, L. A., Herrera, R. F., and Alarcón, L. F. (2020). “Exploring the Relationship Among Planning Reliability (PPC), Linguistic Action Indicators and Social Network Metrics.” *Proc. 28th Annual Conference of the International Group for Lean Construction (IGLC)*, I. D. Tommelein and E. Daniel, eds., Berkeley, California, USA, 109–118.
- Romney, A. C., Smith, I. H., and Okhuysen, G. A. (2019). “In the trenches: Making your work meetings a success.” *Business Horizons*, “Kelley School of Business, Indiana University,” 62(4), 459–471.
- Salazar, L. A., Arroyo, P., and Alarcón, L. F. (2020). “Key Indicators for Linguistic

- Action Perspective in the Last Planner® System.” *Sustainability*, Multidisciplinary Digital Publishing Institute, 12(20), 8728.
- 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.
- Salazar, L. A., Retamal, F., Ballard, G., Arroyo, P., and Alarcón, L. F. (2019). “Results of indicators from the Linguistic Action Perspective in the Last Planner(r) System.” *Proc. 27th Annual Conference of the International Group for Lean Construction (IGLC)*, Pasquire C. and Hamzeh F.R., ed., Dublin, Ireland, 1241–1250.
- Salgin, B., Arroyo, P., and Ballard, G. (2016). “Exploring the relationship between lean design methods and C & D waste reduction: Three case studies of hospital projects in California [Explorando la relación entre los métodos de diseño lean y la reducción de residuos de construcción y demolición: tres .” *Revista Ingenieria de Construccion*, 31(3), 191–200.
- Thornton, B., Faires, A., Robbins, M., and Rollins, E. (2014). “The Mere Presence of a Cell Phone May be Distracting.” *Social Psychology*, 45(6), 479–488.
- Verrier, B., Rose, B., and Caillaud, E. (2016). “Lean and Green strategy: the Lean and Green House and maturity deployment model.” *Journal of Cleaner Production*, 116, 150–156.
- Viana, D. D., Formoso, C. T., and Isatto, E. L. (2011). “Modelling the network of commitments in the last planner system.” *19th Annual Conference of the International Group for Lean Construction*, Lean Construction Institute, Lima, Perú.
- Viana, D. D., Formoso, C. T., and Isatto, E. L. (2017). “Understanding the theory behind the Last Planner System using the Language-Action Perspective: two case studies.” *Production Planning & Control*, Taylor & Francis Ltd, 2-4 Park Square, Milton Park, Abingdon OR14 4RN, Oxon, England, 28(3), 177–189.
- Weinheimer, N. (2016). “The process of green building certification: An examination regarding lean principles.” *IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction*, 53–62.
- Weinheimer, N., Schmalz, S., and Müller, D. (2017). “Green building and lean management: Synergies and conflicts.” *IGLC 2017 - Proceedings of the 25th Annual Conference of the International Group for Lean Construction*, 911–918.
- Yin, R. K. (2003). *Case Study Research: Design and Methods*. SAGE Publications, Applied Social Research Methods. Volume 5, Thousand Oaks, CA.
- Zegarra, O., and Alarcon, L. F. (2017). “Variability propagation in the production planning and control mechanism of construction projects.” *Production Planning & Control*, Taylor & Francis Ltd, 2-4 Park Square, Milton Park, Abingdon OR14 4RN, Oxon, England, 28(9), 707–726.
- Zegarra, O., and Alarcón, L. F. (2013). “Propagation and distortion of variability into the production control system: Bullwhip of conversations of the last planner.” *21st Annual Conference of the International Group for Lean Construction 2013, IGLC 2013*, The International Group for Lean Construction, Fortaleza, Brazil, 589–598.