Ronceros, K., Ronceros, H., Mio, L., Miranda, O., Chicoma, J., & Soto, R (2025). Kaizen events for the development of the Last Planner System® maturity in a construction project. In O. Seppänen, L. Koskela, & K. Murata (Eds.), *Proceedings of the 33rd Annual Conference of the International Group for Lean Construction* (IGLC33) (pp. 471-482). https://doi.org/10.24928/2025/0229

KAIZEN EVENTS FOR THE DEVELOPMENT OF THE LAST PLANNER SYSTEM® MATURITY IN A CONSTRUCTION PROJECT

Kevin Ronceros [1], Harold Ronceros [2], Luis Mio [3], Oscar Miranda [4], Jose Chicoma [5] and Ricardo Soto [6]

ABSTRACT

The construction industry has shown limited advances in innovation and productivity compared to other sectors, despite its global economic relevance. In response to this scenario, companies have adopted practices such as Lean Construction (LC) and tools such as the Last Planner System® (LPS), designed to improve planning and performance in projects. However, the adoption of the LPS is limited by partial implementation that limits the capacity of the system. This research arises as an initiative to develop a structured method that allows a systemic implementation of all the components of the LPS, supported by the Maturity Model (MM) of the LCI lean IPD focused on LPS and Kaizen events to strengthen the adoption of all the components of the LPS. The case study of development during 43 weeks in the construction of the structural shell of the new FIIS-UNI building. During the application of the proposed method, the eight components of the LPS were developed from the development of 43 Kaizen events during the application of the proposed method. This article documents the experience of applying the proposed method and presents a sequential guide of steps to replicate the experience in another construction project.

KEYWORDS

Maturity Model, Kaizen events, Last Planner System®, Integrated Project Delivery, Lean Construction.

INTRODUCTION

LPS implementation in construction companies is essential by its benefits such as: safety, production predictability, reduction of project duration, efficient cost management and promotion of team collaboration. For this reason, there is a need to develop formal strategies for the implementation of LPS; since in the research by Fernandez-Solis et al. (2018), only 59% of the organizations surveyed had a formalized strategy. In addition, the studies by Lagos (2017) and Daniel (2017) indicate that the implementation of LPS tends to be short-term, and the most common applied components include weekly planning, CNC search and PPC measurement.

1 Production Engineer, National University of Engineering, Lima, Perú, kevin.ronceros.p@uni.pe, orcid.org/0009-0005-1205-3833
2 Civil engineer, National University of Engineering, Lima, Perú, hroncerosp@uni.edu.pe, orcid.org/0009-0004-4832-9232
3 Civil engineer, National University of Engineering, Lima, Perú, luis.mio.r@uni.pe, orcid.org/0009-0001-3730-2016
4 Civil engineer, National University of Engineering, Lima, Perú, omiranda@uni.edu.pe
5 Civil engineer, National University of Engineering, Lima, Perú, jose.chicoma.m@uni.pe
6 Civil engineer, National University of Engineering, Lima, Perú, luis.soto.j@uni.pe

This being a partial implementation that prevents the system capacity from reaching its maximum efficiency.

Pérez (2021) also mentions that the LPS is not being implemented in a holistic manner, since structured methodologies have not been adopted to facilitate the control and monitoring of the LPS implementation process, which causes the effectiveness and efficiency of the LPS to be lower than expected, thus reducing the competitiveness of companies that have recently adopted this system. Therefore, a method based on the LPS-LCI MM supported by structured kaizen events is proposed to manage the maturity of the LPS. This is an existing proposal in the literature that serves as a good starting point for this research.

Based on the research mentioned above, the need arises to develop a structured method that allows a progressive, measurable, sustainable, complete and specific implementation for the LPS, this being the main objective of this research since the question of this research is the following:

How can a structured method that integrates Kaizen events and the LPS-LCI Maturity Model be implemented to facilitate the progressive development of the maturity of the Last Planner System®?

This article answers the research question by applying a structured method based on the methodological structure of the generic method of Ronceros et al. (2024) where the MM LPS-LCI and the structured Kaizen events are integrated. The proposed method to develop the maturity of the LPS is a specific application of the generic method of Ronceros et al. (2024). With a focus on developing the maturity of the LPS in a construction project in Lima - Peru.

LITERATURE REVIEW

According to Fauchier et al. (2013), LPS is considered a key starting point for introducing Lean culture in organizations. Similarly, Ballard (2000) points out that multiple investigations have documented successful LPS implementations in a wide variety of projects carried out in various countries, including the United States, Brazil, Chile, Ecuador, England, Finland, Denmark, among others.

Porwal et al. (2010) postulated that the development of action plans for the implementation of LPS entails a set of crucial steps to guarantee success in the adoption and use of LPS. In addition, a study carried out by Fernández-Solis et al. (2018), which included a survey directed to 44 companies that implement LPS, revealed that only 59% of organizations have a formalized strategy to carry out the implementation of LPS. This percentage illustrates the lack of a standardized methodology for the incorporation of LPS, even in those companies that bet on the Lean Construction philosophy. To this end, the Lean Construction Institute (LCI) presents a MM called LPS–LCI, designed to assess the level of implementation of the Last Planner System (LPS) in organizations. This model facilitates the assessment of the current state, and the formulation of action plans aimed at improving the implementation of the LPS, as highlighted in the research by Pérez (2021).

On the other hand, Lagos (2017) conducted a bibliographic review on the implementation of the components of the LPS System based on the work of 9 other authors. This analysis covered a set of more than 100 cases in which the LPS was applied. Among which it was concluded that the implementation of the LPS has tended to be predominantly short-term.

Daniel (2017) analyzes 57 case studies published by the International Group for Lean Construction (IGLC) and shows an increase in the adoption of the LPS over time. Their research identifies an increase in the reported use of several elements of the LPS, although it notes that the comprehensive implementation of the system remains a challenge for many organizations. The study highlights that PPC measurement, weekly work planning meetings and non-compliance reason log (CNC) are the most frequently adopted components according to the reviewed IGLC documents. This reflects a trend towards partial implementation of the LPS and

highlights that the orientation of its application has been predominantly focused on short-term objectives. Likewise, Ronceros et al. (2024) propose a method to facilitate the adoption of LC in the production management of a construction project. Based on structured Kaizen events to facilitate the development of LC maturity in production management. This method turns out to be generic, since it can be used in combination with any MM to develop any approach to the LC philosophy.

RESEARCH METHODOLOGY

The research method is developed in two stages: (1) Theoretical-Conceptual, which includes an exploratory literature research and a descriptive research, in which the maturity model focused on LPS and the continuous improvement method were selected to complement the use of MM in the adoption of LPS; and (2) Research-Action, which includes the proposed method and its validation through application in a case study. This is outlined in Figure 1.

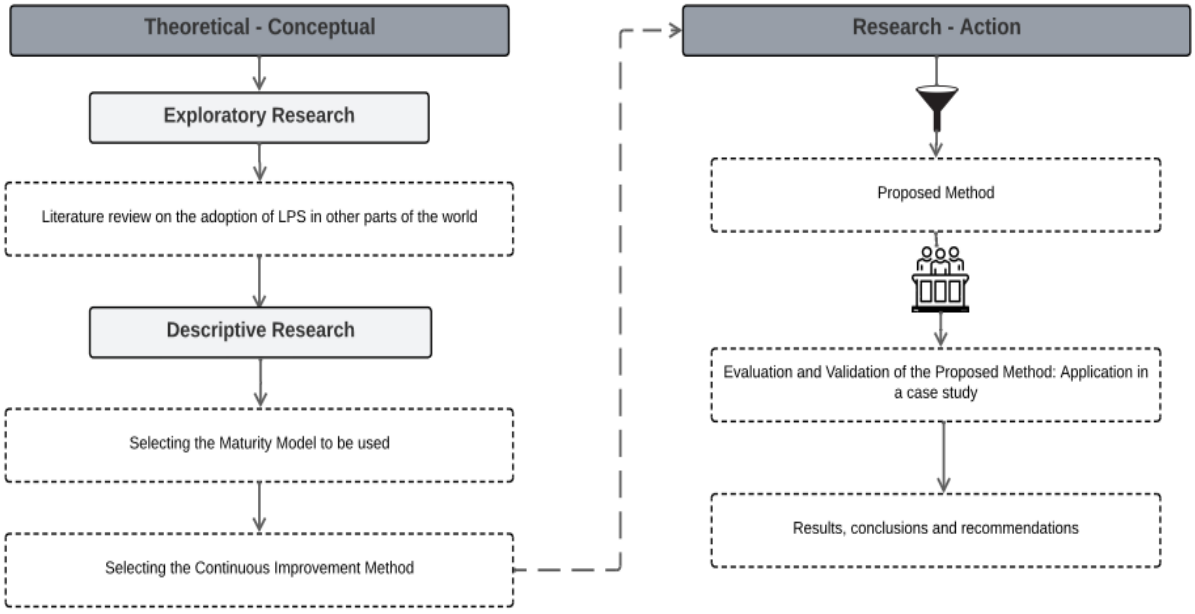


Figure 1: Research methodology

DEVELOPMENT OF THE PROPOSAL

The proposal is based on the integration of the principles of Toyota Kata model by Rother (2016), Kaizen events by Aoki (2008) and the systematic method for production management by Ronceros et al. (2024). These approaches are in conjunction with Health and Maturity Assessment MM by LCI Lean IPD (LCI, 2016). They enable the creation of learning organizations through experimentation in unpredictable, unknown and complex territories on the path to adopting the LPS maturity approach in a construction project.

The method proposed in this article is a continuation of the research by Ronceros et al. (2024), where the diagnostic instrument for maturity is the MM by LCI Lean IPD (LCI, 2016) and the focus is to facilitate the development of LPS maturity for its progressive adoption in the production management of a project. Figure 2 shows the general scheme of the proposed method which is described below:

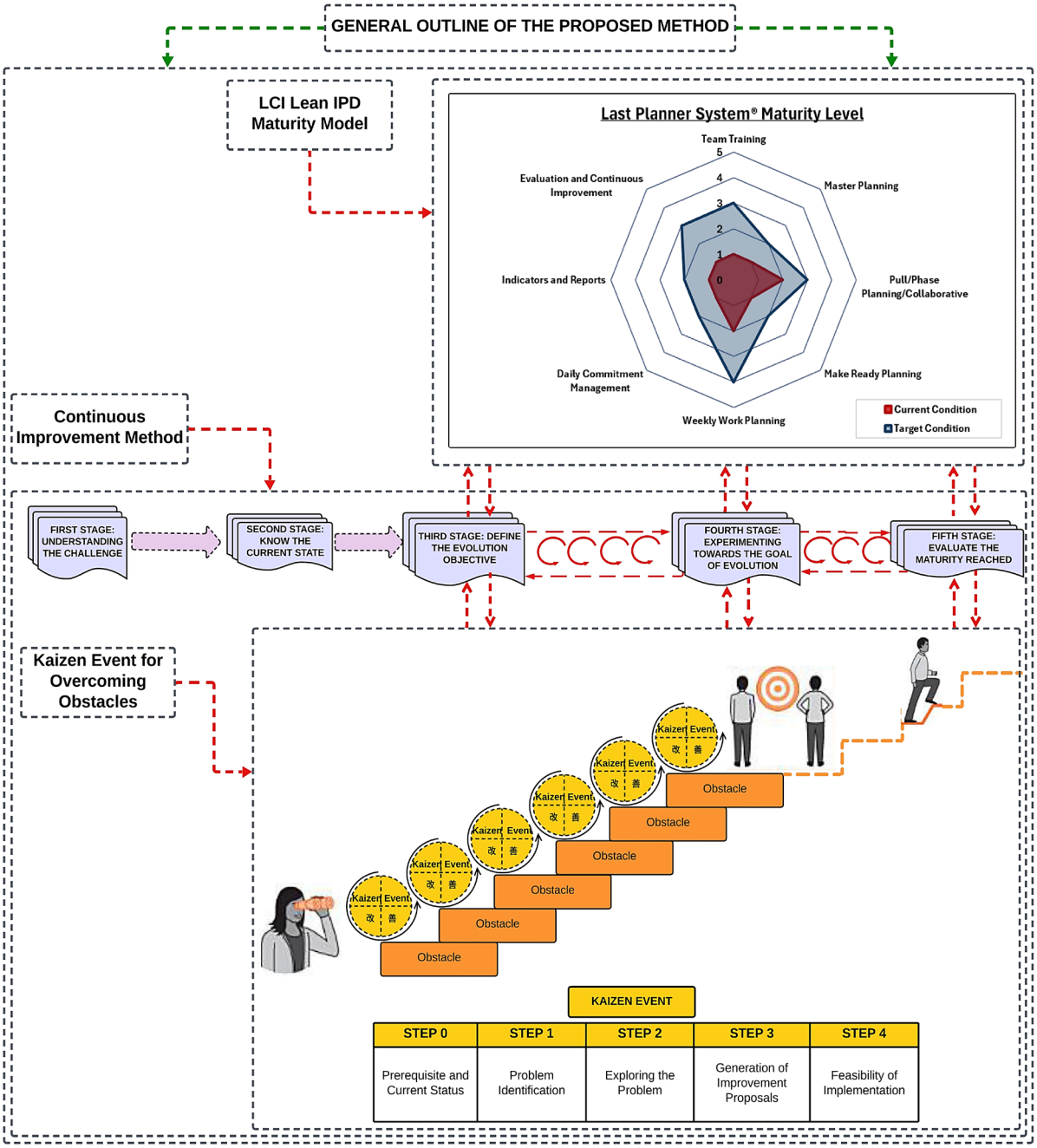


Figure 2: Proposed method

First Stage: Understanding the Challenge

The initial stage of the method aims to understand the challenge that the team has set itself and the context in which it will be developed. This challenge is presented as an achievable goal in the short or medium term, linked to daily work and improvement activities. Being a concrete, measurable and accessible objective, it provides a clear direction with which the members of an organization identify.

Second Stage: Knowing the Current State

In this stage, the MM by LCI Lean IPD (LCI, 2016) is used, focusing specifically on the evaluation instrument for LPS, this is the LPS-LCI as the diagnostic tool to quantify and qualify the level of adoption of the LPS in a production system.

THIRD STAGE: DEFINING THE EVOLUTION OBJECTIVE

The third stage seeks to establish an objective to develop maturity in a dimension of the MM of the LCI Lean IPD (LCI, 2016) as considered by the work team. Production managers must set realistic and achievable evolution objectives, which must be based on the current state and in the direction of the challenge posed.

FOURTH STAGE: EXPERIMENTING TOWARDS THE EVOLUTION OBJECTIVE

The experimentation from the current condition to the desired condition is carried out from structured Kaizen events. Kaizen events are the strategy used when there is not necessarily support from management or the heads of the organization and when no prior knowledge of the principles or tools of LC is detected. In this research, the structured Kaizen event was based on Imai (1986), Sharma & Moody (2003), Shingo (2010), Vivan et al. (2016), and Muñoz (2020). The structured Kaizen event will consist of five steps that are fed back by the experimentation of the obstacles encountered and overcome during the path towards the proposed evolution objective. These five steps are detailed below:

Step 0: Prerequisites and status

In this step, production managers analyze the current maturity status, considering its division into parts or groups of elements, so that the complexities of each maturity dimension are reduced to more manageable elements, where improvement opportunities can be identified, and evolution objectives can be prioritized. This step allows efforts to be concentrated in a single direction that is aligned with the proposed challenge.

Step 1: Problem Identification

Shingo (2010) argues that an improvement or development of a Kaizen should only be implemented after the participants have achieved a solid understanding of the identified problem. Therefore, at this stage tools such as 5S, VSM, LOB and direct consultation with workers in the production area (Gemba) are incorporated. These techniques allow the problems detected to be identified, listed and classified, as well as establishing a connection with the 8 types of waste in lean production. In this way, a deep understanding of the problems found in the production system is achieved.

Step 2: Exploring the problem

This step focuses on carrying out a root cause analysis of the identified problems, following an order of priority, with the purpose of categorizing their causes. As Shingo (2010) points out, science is concerned with systematically organizing existing knowledge. This approach can be applied to solve problems quickly and accurately, eliminating any ambiguity. Likewise, by classifying and organizing the causes of the problems, it is possible to establish a clear direction.

Step 3: Generating improvement proposals

The first step is to encourage a creative approach, and the brainstorming technique is ideal for generating innovative ideas in a constraint-free environment. In this context, Shingo (2010) highlights four key principles: avoiding any criticism of ideas, valuing unconventional proposals, generating as many ideas as possible and encouraging association between them. Once the improvement proposals have been formulated, they must be evaluated through three questions that determine their partial acceptance. If the proposal passes all the filters and is approved by the production managers, the next step is taken.

Step 4: Feasibility of Implementation

According to Vivan (2016), this stage aims to establish the parameters necessary to implement the improvements. To do this, a VSM is developed that represents the future state based on the

improvement proposals defined in step 3. Subsequently, it is essential to define key indicators, such as productivity, waste of resources, ratios, among others, that will allow describing the current situation, monitoring the process and evaluating whether the solution generates the expected benefits.

FIFTH STAGE: EVALUATE THE MATURITY ACHIEVED

The fifth stage of the method aims to evaluate the level of maturity achieved after the implementation of Kaizen events designed to meet the stated objective. This evaluation will be carried out using the same maturity model (MM) selected during the second stage.

CASE STUDY

The case study where the proposed method for the adoption of the LPS was applied is a construction project for a 7-story building with 2 basements, and a construction area of 2000 m2, with a budget of 15.5 million dollars. The execution modality is by direct administration and the executor is the Investment Executive Unit (UEI) of the National University of Engineering (UNI) in Lima - Peru, being the UEI an organization where the Lean philosophy and its tools for project management are not put into practice. The application is carried out during the execution phase of the structural shell of the new intelligent building of the Faculty of Industrial and Systems Engineering (FIIS) of the UNI. The objective of the application of the proposed method is to facilitate the adoption of the LPS in the FIIS-UNI project, since the structural shell of the basements was already under construction. The initiative to carry out an implementation during the execution of a project is based on what was suggested by Mossman (2016), with the LPS implementation framework during the execution of a project.

FIRST STAGE: UNDERSTANDING THE CHALLENGE

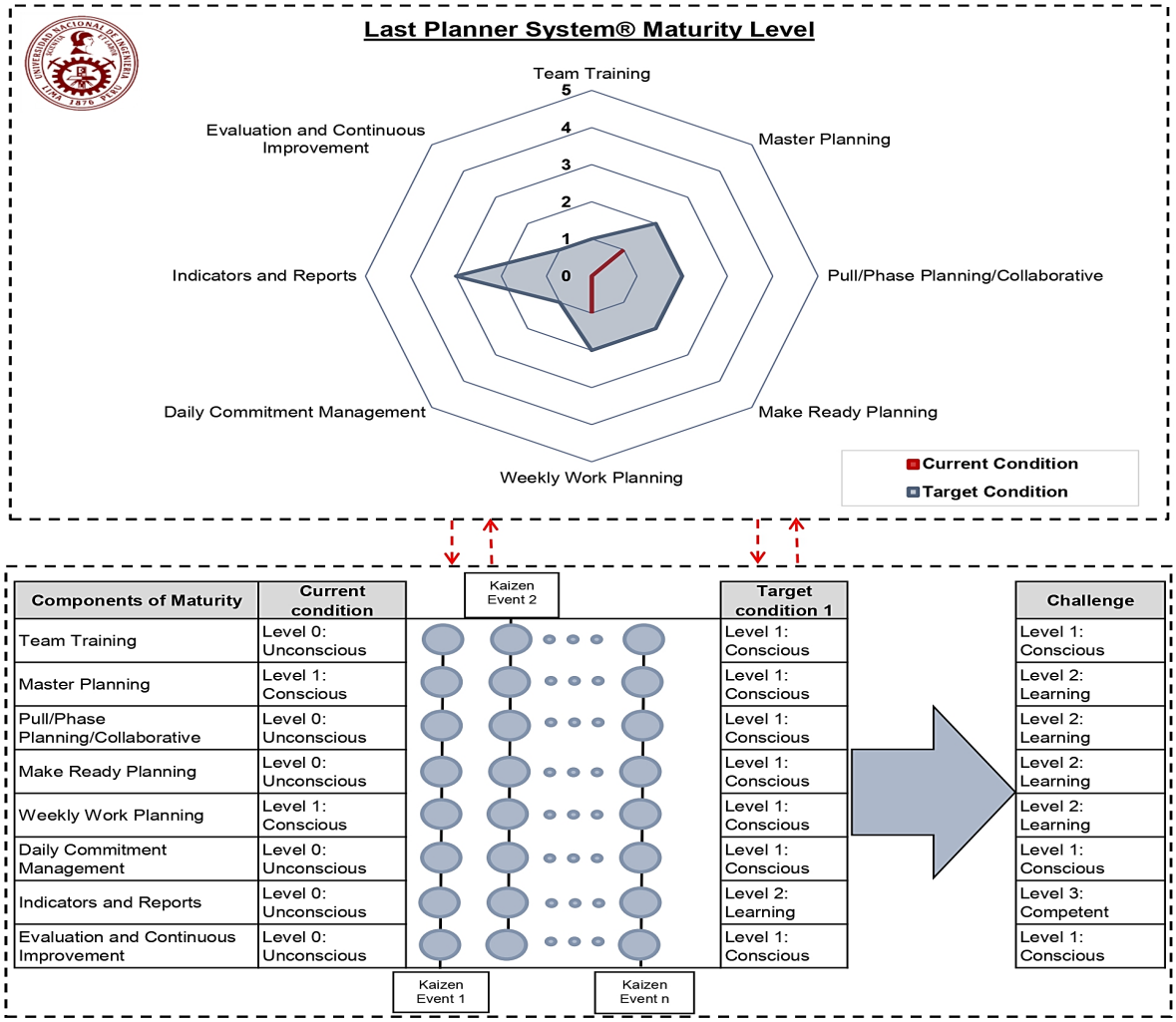
In this case, the proposed challenge is the adoption of the LPS to manage the production system of the structural hull of the FIIS-UNI project. The scope of this adoption seeks for the components of the LPS-LCI maturity model to reach at least level 2 (learning). That is, all the components of the LPS-LCI maturity model have to reach level 1 (conscious) in the production system of the project. This is the direction or true north that will be taken in this case study.

SECOND STAGE: KNOWING THE CURRENT STATE

The organization executing the project is an organization that has been working in a traditional way with a traditional organizational structure and without traces of knowledge or application of LC. This conclusion is reached by performing the MM LPS-LCI evaluation test, where the current state rating can be shown in Figure 3.

THIRD STAGE: DEFINING THE EVOLUTION OBJECTIVE

Based on the current maturity status, improvement opportunities were identified in line with the proposed challenge. Efforts were focused on the identified improvement opportunities, as can be seen in Figure 3.



Components of Maturity	Current condition	Target condition 1	Challenge
Team Training	Level 0: Unconscious	Level 1: Conscious	Level 1: Conscious
Master Planning	Level 1: Conscious	Level 1: Conscious	Level 2: Learning
Pull/Phase Planning/Collaborative	Level 0: Unconscious	Level 1: Conscious	Level 2: Learning
Make Ready Planning	Level 0: Unconscious	Level 1: Conscious	Level 2: Learning
Weekly Work Planning	Level 1: Conscious	Level 1: Conscious	Level 2: Learning
Daily Commitment Management	Level 0: Unconscious	Level 1: Conscious	Level 1: Conscious
Indicators and Reports	Level 0: Unconscious	Level 2: Learning	Level 3: Competent
Evaluation and Continuous Improvement	Level 0: Unconscious	Level 1: Conscious	Level 1: Conscious

Figure 3: Maturity assessment and opportunities for improvement

FOURTH STAGE: EXPERIMENTING TOWARDS THE TARGET CONDITION

The LPS adoption process begins by taking advantage of the improvement opportunities identified in the previous stage of this method. In the case of the FIIS-UNI project, it began with the "Master Plan" component of the LPS-LCI MM (see Figure 4). Where planning is adopted by creating team alignment around milestones defined in the master plan, the participation of the last planners in the macro estimation of the deadlines and the visualization of the sequence through the BIM model of the structural shell of the project.

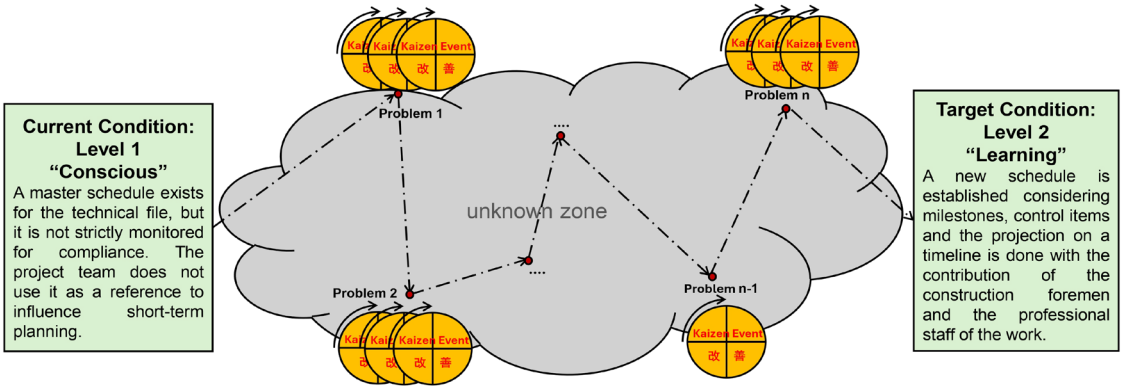
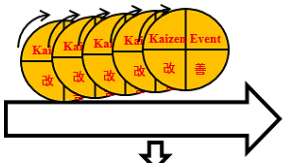


Figure 4: Experimenting through Kaizen events to reach the target condition

In the same way as can be seen in Figure 4, it was decided to experiment through Kaizen events in each of the LPS components. Following the recommendations of Ballard and Tommelein (2016) regarding the importance of carrying out a holistic implementation of the LPS because the omission of a part destroys the capacity of the system to fulfill its functions. This is how the eight measurable components of the LPS were developed according to the MM LPS-LCI, because the organization does not have prior knowledge of LPS. It began by carrying out training on the main LPS tools and metrics, to speak a common language and begin to forge a basic awareness and habits of the system such as starting with weekly plans and anticipation through the Make Ready tool. In this way, we seek to start the adoption from the most basic level of the LPS so that the entire team begins to have an awareness of what we should, can, will do and did in the execution of the project. The first Kaizen event was carried out in the "Weekly Work Planning" component as shown in Figure 5.

Current Condition
Level 1 (Conscious): Each foreman focuses primarily on his or her own scope of work front, regardless of the previous or subsequent process in the production chain.



Target Condition
Level 2 (Learning): Foremen discuss their work needs and learn about each other. They learn to make commitments with clearly defined conditions of satisfaction and learn to report variations from the plan. Plan development is a habit that is practiced week by week.

Kaizen Event					
Identify the Problem	**Exploring the Problem**	**Creation of the Improvement Proposal**	**Feasibility of implementation**		
Obstacle	**Root cause**	**Planned Action**	**What is expected?**	**What was done?**	**What is learned?**
Week after week, work is carried out that has been verbally defined between the foremen and the technical team of the work. Metrics of compliance with the weekly plan are not generated, and the inventory of work free of restrictions is not identified.	There is a lack of standardization of LPS formats. It can be observed that there are no standardized formats for the generation of short- and medium-term plans, and there are no meetings where the latest planners are involved.	Train the latest planners in the use of lean tools that facilitate the application of LPS.	It is expected that habits will be acquired that are oriented towards the use of LPS as a common way of working among the latest planners.	The construction manager and foremen were trained in the use of Make Ready and in filling out the weekly plan form on site.	The repeated practice week after week allowed the generation of assumed behaviors that over time became a habit for the latest planners.
		Metrics are defined to evaluate the performance of the commitments made by the latest planners.	It is expected to measure the performance of the commitments made and to forge the concept of reliable promises among the latest planners.	Week by week, measurements were taken of the percentage of plan complete (PPC), list of main identified constraints and indicators of schedule and cost performance.	Performance indicators allowed workers to be encouraged to meet their commitments. A competitive environment was created to improve or maintain the project metrics.

Figure 5: Development of a Kaizen event

The development of this Kaizen event allowed the adoption of the maturity characteristics that qualify for a maturity level 2 in the "Weekly Work Planning" component. The same was done for each of the LPS components according to the MM LPS-LCI during the 43 weeks of duration of this application in the FIIS-UNI project.

FIFTH STAGE: EXPERIMENTING TOWARDS THE TARGET CONDITION

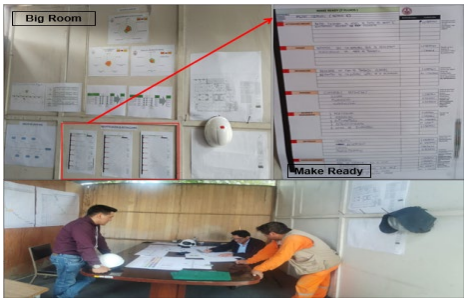
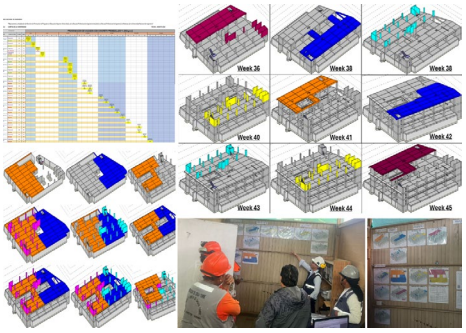
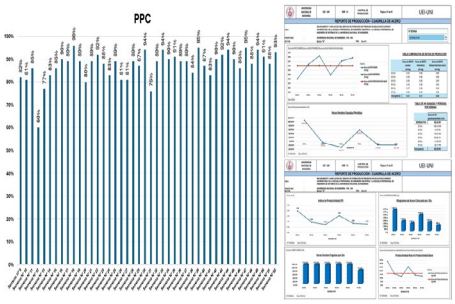
After completing the application of 43 Kaizen events aimed at developing the eight components of the LPS according to the MM LPS-LCI, a new assessment of the maturity achieved was carried out, finding that the components associated with the LPS managed to meet the challenge posed in Figure 3. This validated the effectiveness of this method for the development of the maturity of the LPS in the FIIS-UNI project.

Finally, the case study allows us to document lessons learned during the implementation. As the planning routines are generated with the production team, these allow them to adopt critical thinking behaviors and awareness of the Lean tools used for the adoption of the LPS. They learned to identify jobs that do not add value, the habit of identifying restrictions so that the production flow does not stop. This is how maturity level 2 (Learning) was achieved in most of the LPS components.

RESULTS

Table 1 shows the development of LPS component maturity for six of the eight target conditions exceeded in the project during the application of Kaizen events.

Table 1: Maturity level of LPS components defined in each condition

Component/ Condition	Initial Condition	Condition Achieved	Illustration of the Condition Achieved
Team Training	**Level 0: Unconscious** There is no evidence of use of standards for the development of the LPS in project management	**Level 1: Conscious** Training was provided and formats were adopted for the use of Make Ready during short-term planning.	
Master Planning	**Level 1: Conscious** There is only one master schedule of the technical file at the macro level.	**Level 2: Learning** A master plan and a milestone schedule were developed reflecting the reality of the execution and times were estimated with the support of the foremen and the BIM model.	
Pull Phase/ Collaborative Planning	**Level 0: Unconscious** The projection and estimation of the execution was carried out in isolation by the construction resident.	**Level 2: Learning** The execution projection is carried out through compromise struggle and negotiation with the capable and engineers.	
Weekly Work Planning	**Level 0: Unconscious** The execution is guided only by the instructions given to the capable person by his superior in charge.	**Level 2: Learning** The foremen discuss their needs and learn about the experiences that have occurred on other work fronts.	
Indicators and Reports	**Level 0: Unconscious** There are no indicators that allow us to understand the performance of the commitments assumed.	**Level 3: Competent** Performance indicators are implemented in commitment and efficiency of the workforce.	

Evaluation and Continuous Improvement	**Level 0: Unconscious** The team operates under the direction of traditional leaders.	**Level 1: Conscious** Introduction and sporadic use of Plus and Delta and Ishikawa is carried out	

CONCLUSIONS

The proposed method employs the LPS-LCI Maturity Assessment as a tool to diagnose the current state of LPS adoption, identify the characteristics of more advanced levels and establish a target objective. In addition, Kaizen events allow reaching the desired condition, being the method proposed in this document a structured guide with a sequence of steps to manage sequential improvements. This approach facilitates the transfer of knowledge between team members through actions designed to overcome obstacles, helping to overcome cultural barriers and achieving an LPS configuration adapted to the project. The article seeks to present and document the experience gained during the application of this method, which allowed implementing all LPS components in a construction project without prior knowledge of LPS, achieving the objective through 43 Kaizen events. Of which only one kaizen event is detailed in this document for practical purposes.

The proposed method was able to achieve level 3 in one of the LPS components and level 2 in four LPS components. Unlike research such as Daniel (2017) and Lake (2017), where the LPS was implemented partially, limiting and restricting the full use of its capabilities, this proposal allowed the organization to implement all the LPS components, maximizing its potential at the level of maturity achieved.

The application of the tool to assess the health and maturity of the Lean IPD LCI provided the organization and the project team with a more comprehensive view, going beyond the scope of the LPS. In addition, this tool contributed to incorporating a lean culture in the organization, promoting the active participation of the team in the project results and optimizing the management of the resources necessary for its execution.

It is suggested that future research may update the assessment of the LPS-LCI maturity model, incorporating new advances related to the LPS and adapting it to the specific characteristics of the organization where it is planned to be applied. This is especially relevant, given that the current questionnaire lacks a sufficient level of detail, and its application may be influenced by the subjectivity of the evaluator. In order to use it, it is necessary to adapt it to the specific conditions of the organization and the good practices of organizations in the sector that are more advanced in their adoption. Likewise, it is proposed to use this method as a tool to implement other key elements of the lean culture within an organization.

In order to implement the proposed method effectively, it is recommended to establish at least two key roles during the development of the Kaizen event: (1) a role for managing and promoting the event, responsible for leading and promoting the participation of the project members (Kaizen Leader), and (2) a role focused on the detailed monitoring and follow-up of the production system, both in the pre- and post-application stages of the proposed method (Kaizen Apprentice).

REFERENCES

Aoki, K. (2008). Transfer of Japanese kaizen activities to overseas plants in China. *International Journal of Operations & Production Management, 28*(6), 518-539. https://doi.org/10.1108/01443570810875340

Ballard, G. (2000). *The Last Planner System of production control* [Doctoral dissertation, University of Birmingham]. https://etheses.bham.ac.uk/id/eprint/4789/

Ballard, G., & Tommelein, I. (2016). Current process benchmark for the Last Planner System. University of California, Berkeley. https://p2sl.berkeley.edu/wp-content/uploads/2016/10/Ballard_Tommelein-2016-Current-Process-Benchmark-for-the-Last-Planner-System.pdf

Daniel, E. (2017). *Exploratory study into the use of Last Planner ® System and collaborative planning for construction process improvement* [Doctoral dissertation, Nottingham Trent University]. http://irep.ntu.ac.uk/id/eprint/31057

Fauchier, D., & Alves, T. (2013). Last Planner® System is the gateway to lean behaviors. In *Proceedings of the 21st Annual Conference of the International Group for Lean Construction*. (pp. 559-568). Obtenido de https://iglc.net/Papers/Details/898

Fernandez-Solis, J., Porwal, V., & Lavy, S. (2018). Guidelines to address challenges faced by Last Planner users and implementers at organizational and project levels. Texas A&M University. http://hdl.handle.net/1969.1/166276

Imai, M. (1986). *Kaizen: The key to Japan's Competitive Success*. McGraw-Hill.

Lagos, C. (2017). *Development and implementation of tools to improve Last Planner information management* [Master thesis, Pontificia Universidad Católica de Chile]. https://doi.org/10.7764/tesisUC/ING/21403

LCI. (2016). *LCI Lean IPD Health and Maturity Assessment Tool 1.0*. Retrieved from https://www.leanconstruction.org/pages/learning/tools-and-technologies

Muñoz, K. (2020). *Proposal for methodological bases for the promotion of a culture based on continuous improvement in construction* [Undergraduate thesis, Universidad de Chile]. https://repositorio.uchile.cl/handle/2250/178548

Perez Apaza, J. (2021). *Proposal for a continuous improvement system to facilitate the maturity of the Last Planner System during the execution of a project* [Undergraduate thesis, Universidad Nacional de Ingeniería]. http://hdl.handle.net/20.500.14076/22207

Porwal, V., Fernández-Solís, J., Lavy, S., & Rybkowski, Z. (2010). Last Planner System implementation challenges. In *Proceedings of the 18th annual conference of the International Group for Lean Construction*. (pp. 548-556). http://iglc.net/Papers/Details/686

Rodegheri, P., & Serra, S. (2020). Maturity Models to evaluate Lean Construction in Brazilian projects. *Brazilian Journal of Operations & Production Management, 17*(2), 1-21. https://doi.org/10.14488/BJOPM.2020.016

Ronceros Ponce, K., Ronceros Ponce, H., Miranda Hospinal, O., & Soto J, R. (2024). Proposal for a methodology to facilitate the development of lean construction maturity in production management. *IX ELAGEC*. https://eic.pucv.cl/wp-content/uploads/2024/11/ELAGEC_2024_FinalPaper_53.pdf

Rother, M. (2009). *Toyota Kata: Managing People to Improve, Adapt and Achieve Superior Results*. McGraw-Hill.

Rother, M. (2016). *Kata Slides & Graphics v4.1*. Retrieved from https://www.slideshare.net/mike734/kata-slides-graphics

Sharma, A., & Moody, P. (2003). *The perfect machine*. Prentice Hall.

Shingo, S. (2010). *Kaizen and the art of creative thinking: the mechanism of scientific thinking*. Enna Products Corporation.

Vivan, A., F, H., & J, C. (2016). Model for the development of kaizen projects for the construction industry. *Gestão & Produção, 23*(2). https://doi.org/10.1590/0104-530X2102-15