

INSTITUTE FOR LEAN CONSTRUCTION EXCELLENCE LEAN MATURITY MODEL (ILMM) – A LEAN MATURITY MODEL FOR INDIAN CONSTRUCTION

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ABSTRACT

In the construction industry, sustained implementation of lean practices is vital for enhancing efficiency and outcomes for projects and organisations. Having a maturity model is one way to assess sustained implementation. This paper identifies the need and describes a comprehensive maturity model framework to gauge and improve project and organisational lean maturity in the Indian construction context – Institute for Lean Construction Excellence Lean Maturity Model (ILMM). The model introduces a distinctive 4x3 matrix, with four levels – Bronze, Silver, Gold, and Platinum – each further divided into three sublevels – Low, Medium, and High. The assessment is done on five dimensions – top management support, process, people & partners, methods & tools, and technology. Field data collection has been done on two projects to see if data on the proposed assessment dimensions can be gathered and an appropriate rating provided to the project along with guidelines on how to improve the maturity.

This research advances lean construction practices by providing a practical framework for continuous improvement and organisational excellence tailored to local construction contexts. In the next phase, the authors plan to do a more elaborate assessment across a broader range of projects and modify the ILMM framework as needed based on their experience.

KEYWORDS

Lean Construction, Lean Maturity Model, Lean Culture, Continuous Improvement, Assessment Framework.

INTRODUCTION

In the dynamic world of construction, variability is constant. Lean construction aims to minimise waste and maximise value, offering a toolkit of methods and tools developed over nearly three decades. Technology, particularly in project information management, has also evolved, providing digitisation as a means to reduce waste. As a result, organisations undertaking lean transformation now have various options, but the specific approach depends on individual projects or organisations. As projects and organisations progress in their lean adoption journey, guided by their awareness and experience, they face challenges in understanding how to sustain implementation and ensure continuous improvement. This

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observation and feedback are particularly notable in the Indian construction industry, which has embraced lean construction practices and technology solutions over the past decade. This paper addresses this critical gap by proposing a maturity model for projects and/or organisations as a means to sustain their lean adoption initiatives.

India has seen significant investment in real estate and infrastructure for the past decade, and this trend is expected to continue (*Infrastructure Development in India: Market Size, Investments, Govt Initiatives* / IBEF, n.d.). As the industry grows, the industry is evolving in its professionalism and is seeing varying levels of adoption of processes like lean construction and technology, including building information modelling (BIM), digitisation of various processes, etc., for the past decade or so (Giridhar et al., 2018; Kalyan et al., 2018; Karanjawala & Baretto, 2018; Ravi et al., 2018; Vaidyanathan et al., 2016). However, our research and interactions with the industry indicate that while there are pockets of adoption and understanding of individual tools and technologies, there has not been a planned, organic, and transformative change that has been effected in any organisation. On the contrary, after a decade of adopting lean construction practices in the country by a few organisations, there is a sense of saturation. The authors realise that as the adoption of lean construction practices grows, so must the tools to assess the level of adoption, provide a roadmap to deepen the adoption and offer an actionable direction to improve the adoption. There is a conspicuous absence of any applicable framework that can benchmark the level of adoption tailored to local intricacies. The proposed maturity model bridges this gap for the Indian construction industry.

The rest of the paper is organised as follows. The next section provides a literature review of available maturity models and a comparison of their strengths and applicability. The third section describes the need for a maturity model identified for the stakeholders in the local Indian construction industry. The fourth section describes the ILMM framework and describes the assessment framework. The fifth section describes the pilot assessment studies done on two projects using the ILMM framework. The last section provides some conclusions and a way forward for the ILMM framework.

LITERATURE REVIEW

A literature review of both available lean maturity models has been done. That helped identify the strengths of each of the models and the motivations behind their evolution. That review coupled with the need in the industry, helped the authors create a maturity model framework that addresses the needs of the local industry while taking into account some of the best practices in the existing models (

Table 1). This literature review is divided into six prominent frameworks across Lean Construction and broader organisational excellence, as outlined below.

LEAN CONSTRUCTION MATURITY MODEL FRAMEWORKS:

LESAT

The MIT - Lean Evaluation of Systems and Tactics (LESAT) helps analyse project outcomes through stakeholder interviews and robust data analysis. It utilises Lean performance indicators (LPis) to evaluate the impact of Lean practices on project goals. Its four levels – Fragmented, Emerging, Integrated, Continuous Improvement – are based on objective data, revealing valuable insights into project performance. However, LESAT's data-driven nature requires significant resources and time, making it less suitable for quick assessments. Additionally, its project-centric focus might neglect the bigger picture of organisational transformation (Massachusetts Institute of Technology, 2012).

HELMA

The Highways England Lean Maturity Assessment Toolkit (HELMA) was developed for infrastructure projects in the UK. HELMA employs a gap analysis approach, comparing your current state with established best practices. Its five levels – Basic, Emerging, Intermediate, Advanced, and Leading – pinpoint areas for improvement and offer resources specifically designed for infrastructure projects. HELMA has been successfully used in this domain, but it might not translate well to other sectors, and its detailed scoring system can be daunting for newcomers (Highways England, 2018).

LCMR

The Lean Construction Maturity Rating (LCMR) offers a Framework for the Progressive Evaluation of Lean Construction Maturity Using a Multi-Dimensional Matrix (FPE-LCMM). Its spider radar charts and bar graphs provide a holistic and dynamic view. It analyses both project-specific and organizational-level factors, guiding you through three strategic stages: Initiation, Integration, and Optimization. While its intricate calculations require expert guidance, the FPE-LCMM provides a comprehensive picture of your lean maturity journey (Sainath et al., 2018).

Nesensohn LCMM

The Nesensohn Lean Construction Maturity Model (LCMM) is a guided step-by-step methodology to help assess the lean implementation path for organisations. This framework focuses on adopting specific tools and techniques, offering a self-assessment questionnaire with four defined levels: Awareness, Initiation, Integration, and Continuous Improvement. Post-assessment provides clear action plans towards mastering key lean practices. However, Nesensohn LCMM's framework and assessment methodology pressed the need for generalisation of the emergent elements of Lean Construction maturity as well as the 11 Key Attributes articulated in the LCMM, which can be confirmed or disconfirmed through further empirical evidence (Claus Nesensohn et al., 2016). Hence, it proves challenging to adapt these concepts to the Indian context, especially considering that the Indian industry is still in the nascent stage of embracing professionalism and incorporating tools and technologies. This underscores the importance of studying the key attributes applicable to Indian contexts, a necessity that must be verified with industry practitioners.

LCI Lean Maturity Model

The LCI Lean Construction Institute Lean Maturity model is an established framework that utilises a familiar self-assessment survey with five levels: Beginner, Aware, Focused, Advanced, and Lean Enterprise. Its binary scoring system offers a baseline for benchmarking and comparing your progress with others. While the LCI model's widespread recognition makes it a valuable tool, its rigidity might not capture the nuances of incremental progress within each level (*Organization Lean Assessment / Lean Construction Institute*, n.d.).

ISO 18404

The ISO 18404 standard offers a comprehensive framework for defining competencies in Six Sigma, Lean, and "Lean & Six Sigma," ensuring clarity and alignment. Structured guidelines and clear definitions facilitate effective implementation. At the same time, its complexity and resource-intensive nature may pose challenges for smaller organisations, potentially limiting inclusivity and hindering complete understanding and implementation (International Organization for Standardization, 2015). Antony et al., (2021) uncovered that the current standard requires improvement to align with industry needs. So, it underscores the importance of consulting industry experts to establish the appropriate dimensions, assessment levels, and criteria for standardizing lean maturity assessments across projects and organisations.

Table 1: Comparison of Lean Maturity Models

Framework	Focus	Methodology	Scoring	Strengths	Weaknesses
LESAT	Project-based assessment for enterprise	Stakeholder interviews and data analysis	Lean performance indicators (LPIs) mapped to maturity levels	Rigorous and data-driven focus on outcomes	High resource requirement, not ideal for quick assessments
HELMA	Infrastructure project context	Gap analysis between current state and desired state	Scoring based on specific criteria for each maturity level	Tailored for infrastructure projects, clear action plans	Not suitable for other sectors, complexity in scoring
LCMR	Multi-dimensional evaluation	Weighted factor model based on spider radar and bar charts	Lean scores mapped to maturity progression curve	Holistic and dynamic, considers project and organisational levels	Requires complex calculations and expertise
LCMM	Organisation-wide lean evaluation	Self-assessment questionnaire with scoring based on adoption levels	Scoring across four levels: Awareness, Initiation, Integration, and Continuous Improvement	Practical and easy to use, suitable for beginners	Limited scope, focuses mainly on 11 key cultural attributes
LCI-LMM	Organisational level assessment	Self-assessment survey with weighted scoring	Five levels: Beginner, Aware, Focused, Advanced, and Lean Enterprise.	Widely used and recognised, suitable for benchmarking	Limited flexibility, binary scoring system
ISO 18404	Organisational & Individual level assessment	Assessment based on personnel and process documentation	Green, Black, and Master Black belts	Structured guidelines to facilitate effective implementation, enhancing education, training, and experience levels for personnel	It is too complex for the Indian context and does not cover technology and other aspects.

POINT OF DEPARTURE

The literature review of various maturity models reveals that each model has its strengths and has been developed for the context in which it has been developed. Applying the model beyond the context and assumptions to which it has been developed will not yield the desired results. In fact, models likely cannot be developed in a very widely applicable framework for it to be effective. Beyond that first point of realisation, the authors realised that there is a need to

document the context in which we are trying to develop a maturity model. Based on the authors' experience in trying to drive lean construction practices in the Indian construction industry over the past nearly fifteen years, the following have been observed:

- Projects or organisations adopt one or more of the processes of the basic lean toolset – Last Planner System™, Value Stream Mapping, Work Sampling, and 5S.
- Adoption set and level of adoption is dependent on the team and organisation.
- Some or most organisations have or are adopting digitisation technology solutions for project collaboration and control, 3D BIM modelling, etc.
- While motivated organisations continue to adopt some combination of the methods and tools and technology solutions, they are unable to proceed to the next level of transformation, leading them to reach a level of saturation.
- Projects and/or organisations are also unable to benchmark themselves with respect to each other to motivate themselves to go to the next level.

Based on the above observations, the authors posit that any maturity model developed for the Indian construction context has to incorporate the following into the framework.

1. Be applicable to the local industry context.
2. Provide flexibility to let organisations decide whether lean adoption should be project-based, organization-based, or hybrid.
3. Provide the ability for teams to make relative comparisons.
4. Data collection and assessment methodology has to be simple, practical, and something that can be easily taught to other assessors.
5. Be objective so the results are unbiased and process, not people-dependent.
6. Be somewhat prescriptive to give organisations a guided roadmap to driving lean transformation over time in a structured fashion.

The proposed model incrementally becomes more comprehensive, allowing objective data collection and evaluation and allowing the adoption to be project- and/or organization-based. However, it has to evolve to meet the above needs with the methodology described below.

RESEARCH METHODOLOGY

From the research method perspective, we are still in an exploratory stage of developing the Lean maturity model. Based on testing the outcomes from this exploratory stage, more rigorous research will be utilized to develop/ refine the ILMM. For developing the Lean Maturity Model for the construction industry in the Indian context involves an evolution from what we learned about the development of the LCMR model. Applied qualitative research methods instrumented for synthesising best practices from literature, conducting brainstorming sessions, presenting to stakeholders at conferences, and conducting pilot studies to develop the framework. This section outlines the systematic process of refining and validating the framework components.

FRAMEWORK EVOLUTION

The core framework for the maturity model evolved from adapting and adopting the best practices from the existing models reviewed and ideating the rest of the framework based on the needs identified as described above. So, while the foundation of our research was laid through the extensive literature review focusing on maturity models within the field of construction and across other industries, the basic tenets of the framework were evolved through collaborative discussion and ideation between the authors.

BRAINSTORMING SESSIONS

Once the basic framework of the model was in place, the authors conducted several unstructured brainstorming sessions with academic researchers and industry professionals. These collaborative discussions aimed to get feedback on the model proposed from industry professionals on its applicability, adoptability by the industry, ease of assessment and other criteria discussed above. The same with academic researchers aimed to question the assumptions that the authors had built into the model, modify the criteria for assessment, and provide a certain level of academic rigor to the proposed approach for periodic and continuous evaluation to get the desired outcomes. All of the conversations also sought to understand and brainstorm the model's applicability to the Indian construction context and any potential limitations to its adoption by the industry. The model presented in the next section results from that iterative dialogue and exchange of insights.

PRESENTATION AND FEEDBACK

Once the model was finalised through the brainstorming sessions above, the proposed model was presented to a wider set of stakeholders at multiple forums. These included the Indian Lean Construction Conference (ILCC) in 2022 and 2023. These presentations served as platforms to solicit feedback from a diverse audience comprising researchers, practitioners, and stakeholders. The input received during these sessions helped refine the model and validate its relevance and effectiveness in addressing industry challenges.

PILOT STUDIES

To validate the practical utility of the developed model, an initial pilot study has been conducted across two construction projects in India. These studies aimed to assess the model's ability to measure the current status of lean maturity within projects and/or organisations and provide actionable insights for improvement to the next level of maturity. More importantly, the project teams accepted the assessment methodology as a benchmark of where they stand and guidance on where they need to go.

In summary, our research methodology integrated theoretical insights, collaborative engagement, stakeholder feedback, and empirical validation to develop ILMM tailored to the specific needs and dynamics of the Indian construction industry. This iterative and inclusive approach ensured the creation of a model that is not only theoretically sound but also practical and actionable in driving organisational transformation. The authors are aware that the model is evolving and will evolve as more assessments are done, but they believe that the current version is ready for industry-wide deployment.

PROPOSED FRAMEWORK

The Institute for Lean Construction Excellence Lean Maturity Model (ILMM) consists of twelve levels as described below and summarised in

Table 2 graphically depicted in Figure 1 below. The assessment methodology to determine the level at which each project and/or organisation encompasses a modified Plan-Do-Check-Act (PDCA) approach is described below.

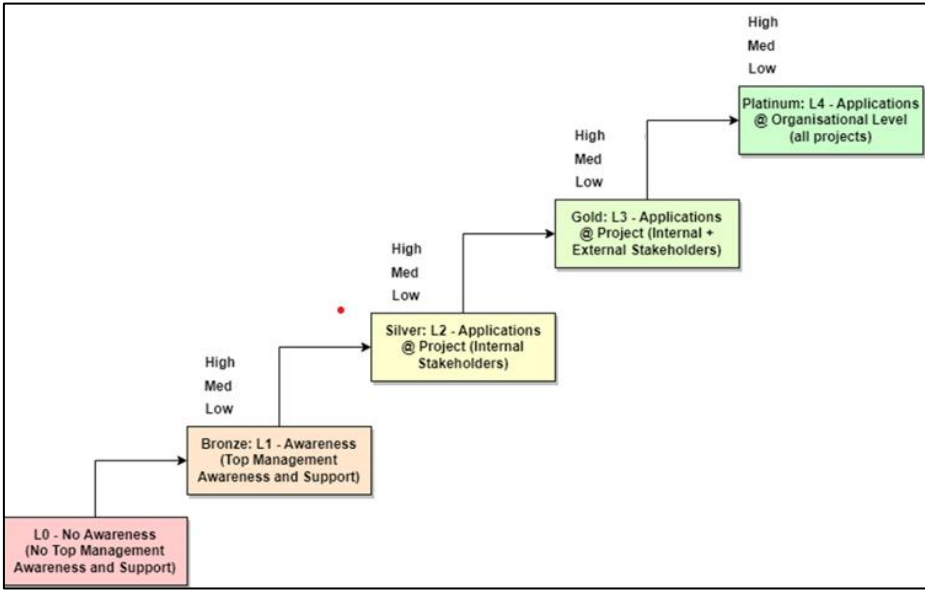


Figure 1: ILCE Lean Maturity Model (ILMM)

ILMM consists of four levels of maturity. Each level provides a significant leap in lean adoption from the previous level. Within each level, the model allows sub-categorization of 3 sub-levels: Low (L), Medium (M), or High (H). These sub-categorizations allow for the measurement of incremental improvement within the maturity level in a relatively smaller time horizon, allowing projects and/or organisations to grow organically to the next level. The four major levels of maturity and their sub-levels are summarised in the table and described briefly below:

7. **L0: NO Awareness:** This level indicates a general lack of awareness and support of lean practices at all levels of the organisation, including the top management. There is no concrete evidence of Lean initiatives in the project and/or organisation at this stage.
8. **L1 – Bronze:** At this level, there is Top Management Awareness of lean, and they commit resources in the form of a lean champion to drive the awareness within the various department heads with increasing adoption among them as they move from Low, Medium, and High as described in the table below.
9. **L2 – Silver:** At this level, lean adoption is done with internal stakeholders of the organisation at the project level driven by a corporate strategy. As the project teams move from Low, Medium, and High, there is an increasing level of adoption among the internal stakeholders, as described in the table below.
10. **L3 – Gold:** At this level, lean adoption is again extended to external stakeholders, driven by a corporate strategy. As project teams move from Low, Medium, and High, there is an increasing level of adoption among the external stakeholders driven by the project team, as described in the table below.
11. **L4 – Platinum:** At this level, lean adoption is happening at the portfolio or business unit level with increasing levels of adoption as described in Table 2 below.

Table 2: ILCE Lean Maturity Model

Maturity Level	Low	Medium	High
L0: No Awareness	Not Applicable	Not Applicable	Not Applicable
L1 – Bronze: Basic Awareness at Top Management Level	Bronze – Low No concrete evidence, but there is a Top management awareness	Bronze – Medium Top management and a FEW HODs attended Lean Awareness Sessions Part-time Lean champion to drive initiatives	Bronze – High Top management and ALL HODs attended Lean Awareness Sessions Full-time Lean champion to drive initiatives
L2 – Silver: Lean Application at Project Level with Internal Stakeholders	Silver – Low Corporate Strategy to adopt Lean practices Education and Training to a FEW Internal stakeholders Setting Operational targets for ONE internal department to adopt basic lean tools	Silver – Medium Execution of basic lean tool adoption in ONE internal department Education and Training to ALL Internal stakeholders Setting Operational targets for the adoption of basic lean tools with ALL internal departments	Silver – High Execution of basic lean tool adoption in ALL internal departments Continual Education and Training to ALL Internal stakeholders
L3 – Gold: Lean Application at Project Level with Internal and External Stakeholders	Gold – Low Corporate Strategy to adopt Lean practices to the next level Education and Training to a FEW External stakeholders Setting Operational targets for ONE External department to adopt basic lean tools	Gold – Medium Execution of basic lean tool adoption in ONE External department Education and Training to ALL External stakeholders Setting Operational targets for ALL Internal departments to adopt basic lean tools	Gold – High Execution of basic lean tool adoption in ALL External departments Continual Education and Training to ALL External stakeholders
L4 – Platinum: Lean Application at Portfolio and Organization Level	Platinum – Low Corporate Strategy to adopt Lean practices to the next level At least 20% of the projects at Gold - High	Platinum – Medium At least 40% of the projects at Gold-High	Platinum – High At least 80% of the projects at Gold-High

It is assumed that broadly, a project team will take around 2 to 2 ½ years to go from one maturity level to another, and they will move from one sub-level to another to another during that period. The lean strategy document that each project team will write provides the flexibility that the team(s) and organisation (s) need to adopt their path to lean transformation. Each could adopt a strategy depending on whether their internal organisational structure is de-centralized (project-based) or, centralised (shared functions), or a hybrid between the two. But within each strategy document, the ILMM model expects that they cover their strategy to adopt lean along five dimensions as discussed below:

1. *Top Management Support:* Based on the author's experience, pursuing lean initiatives without top management support and, consequently, a lack of resources is challenging.

Hence, the authors strongly believe this needs to be aligned before any project team or organisation takes any lean initiatives.

2. *Process*: Understanding and documenting processes is another principle aspect of lean. Documenting processes help identify waste and create pathways for continuous improvement. It also helps benchmark where a project (or organisation) stands on a process and helps them realise how and what to improve and the potential benefits gained through any interventions.
3. *People & Partners*: The authors' experience driving lean awareness and adoption in the Indian construction industry has made them intimately realise that a lot of the success of lean adoption happens after people and teams realise that it is the culture that needs to be changed and transformed – the culture of accountability, trust and transparency among stakeholders (both within and outside organisation), proactive information sharing, and putting project's needs above organisational constraints (sometimes) are critical for the long-term success of lean initiatives. This cultural transformation is critical for the sustained implementation of lean initiatives.
4. *Methods & Tools*: The lean construction research community has created or adopted several lean methods and tools over the past nearly thirty years. But the authors' believe the basic lean toolset is – Last Planner System™ (LPS), Value Stream Mapping, 5S, and Work Sampling. The authors recommend adopting these in the initial phase of lean adoption. The other methods and tools can be adopted organically as understanding and maturity grow. However, the basic tools are necessary to realise the benefits of lean adoption.
5. *Technology*: Technology has always served the purpose of improving productivity and eliminating wasteful processes, including data entry duplication and simplifying project information sharing, collaboration, and control. The authors' believe that adopting technology solutions with a lean mindset of productivity improvement and waste elimination is a better roadmap for technology adoption that makes them more sustainable.

Each level within the ILMM framework is associated with specific criteria along each of the five dimensions outlined above. By providing flexibility but governing it through fixed parameters, the authors believe they can give organisations the flexibility to adopt their own path but, at the overall industry level, provide some level of uniformity during the maturity assessment. That uniformity is critical to allow project teams and organisations to benchmark themselves and figure out how they measure up against the industry. The sub-categorization allows teams to make incremental progress without waiting for long periods and is expected to provide intrinsic motivation.

The assessment of project teams to benchmark them to a certain level of maturity is done through a survey. The assessment methodology is a modified PDCA methodology as outlined below:

- *Plan – Assessment Readiness*: Herein, the project teams and assessors agree to the basics and logistics of the assessment, allowing project teams to prepare the evidence.
- *Do – Assessment*: This is the actual onsite assessment done by the assessors. It is an in-person assessment with the assessors interviewing all the project departments, including the project team members. The assessors are expected to talk not only to the leaders in the functions but also to the supervisors, last planners, storekeepers, engineering document coordinators, billing engineers, etc. Individual interviews and surveys are done with each of the departments. Actual site walk-throughs are to be done by the assessors to gather information through visual inspection in addition to documentary evidence.
- *Check – Reporting & Assessment Action Plan*: Post the onsite visit, the assessors are expected to write a report documenting the current as-is of each department,

highlighting their strengths, the evidence gathered, etc. Based on this, the assessors benchmark the team to a certain maturity level and justify the same based on the evidence collected and gaps identified. The authors are working on a standard template report and are in the early stages of the same. The pilot studies (see below) show how it has evolved as of date.

- *Act – Implement Improvement Action Plan*: This is the implementation phase wherein the project teams implement the recommendations given by the assessors over time, document improvements and advance to the next level of maturity.

The actual assessment is done as a survey. The authors have developed standardised questions for each maturity level (and sub-level) along the five dimensions outlined above. The assessment is expected to take two working days, with the assessors visiting the project teams onsite. The responses to the assessment survey are the evidence that the team provides. The evidence is expected to be documentary evidence (like a certification for having attended a training course, a VSM document, etc.), a visible manifestation of a lean process (for example, a site store organised keeping 5S principles in mind or a Big Room wherein the teams have displayed their lookahead constraints, weekly work plans, PPC etc.) or an interview with individuals of the project teams (for example, What is waste, what is value etc.). The authors have developed an expected set of answers to each survey question. The survey and the expected answers provide some standardisation and objective assessment to the maturity assessment process. As outlined above, the post-assessment report benchmarks the project at a certain level of maturity. It provides actionable recommendations for the team to reach the next sub-level(s) or major maturity level. Finally, with the intent to scale, the authors recommend that the project teams do quarterly self-assessments to ensure that they are making incremental progress and have external assessors do an annual assessment to ensure that major progress is assessed and benchmarked. The next section shows how the methodology was applied on two project sites as a pilot study.

PILOT STUDY

Project: Cement Grinding Unit

The first pilot study was done on a Cement Grinding Unit project. The assessment was done with the main civil contractor whose contractual value in the project is Rs. 85 Crores. The project duration is about 30 months and the site had been functioning for about 18 months when the assessment was done. The project exhibits several strengths in its lean implementation, including robust top management support from the site and head office. There are limited yet documented process maps and no evidence of initial lean awareness training for 25% of the project team members. The site shows a strong adoption of 5S across several departments, including stores, quality, safety, time office, etc. The team has implemented LPS in the critical facilities of the project but not across all the facilities in the contractor's scope. The contractor has also implemented a web-enabled ERP system for data management across some functions, including accounting, finance, and HR.

Based on the outcome of the assessment, the authors, as assessors, have marked the project at a *Bronze – Medium* level of maturity. The recommendations to get to the next level of maturity include filling the gaps and completing some of the incomplete implementations of lean processes. Although the detailed action report is not in the scope of this paper, the main recommendations include items like exhaustive documentation of processes, thorough implementation of LPS, comprehensive lean training for the rest of the project teams, and adoption of other basic lean tools. To get the project team to further their maturity level, they also need to evaluate their technology strategy and deepen the complementary nature of technology and process. Finally, the organisation must develop a lean strategy document

outlining how to operationalise their lean adoption (and hence maturity) through the project and/or organisation.

Project: Underground Metro Construction

The second pilot study was done on an Underground Metro construction project. The assessment was done with the main EPC contractor whose contractual value in the project is Rs. 1,526 Crores. The project duration is about 42 months and the site had been functioning for about 24 months when the assessment was done. From the assessment, it is evident that the project enjoys robust top management support both from the HO and site offices. The team has spent significant effort documenting processes in certain departments like Planning and QA/QC. All the site office personnel had undergone lean training as part of their corporate learning & development process. On an as-needed basis, the team has adopted LPS and constraint identification. At least in the stores, the team had adopted sophisticated technology solutions to monitor and manage material consumption and avoid pilferage. There were dedicated lean champions at the HO level who constantly ideated and drove lean initiatives across various project sites (including this one).

Based on the outcome of the assessment, the authors, as assessors, have marked the project at a *Bronze – Medium* level of maturity. The recommendations include comprehensive lean training for all the field project team members, a more rigorous and continuous adoption of LPS, the basic adoption of other basic lean methods and tools, and the extension of the documentation of processes to the other departments. Although the detailed action report is not in the scope of this paper, the main recommendations to get the project team to further their maturity level included the comments discussed above. Here, the assessors also recommend that the organisation develop a lean strategy document that outlines how they plan to operationalise their lean adoption and complementary digitisation strategy evolution (and hence maturity) through the project and/or organisation.

CONCLUSIONS

In conclusion, the authors have presented a maturity model that addresses the needs for the Indian construction industry. The model is currently the first version of the maturity model, and the authors believe that the model will evolve as more assessments are done. It should be noted that both the pilot project sites were done with organisations that had been practising lean in various forms for the past few years and had reached a sort of saturation point. The outcome of the assessment report has been presented to the project teams and organisations. The objective is to give organisations a concrete set of actions to implement and a guideline for adopting and growing their lean adoption to the next level.

One of the limitations of the current model and pilot studies is that it is not clear how the model will perform on a portfolio of projects within the same organisation and how the outcomes will interplay when assessment is done on various projects within the same organisation. The authors are aiming to address this in their next phase of research and potentially modify the maturity model based on the learning that comes out of that study. In the next phase, the authors are also looking to run pilot studies on projects and organisations that have not started on their lean transformation journey. Finally, the authors are looking to do a second assessment on the existing project sites and see if the maturity levels do advance (assuming the project teams did implement the recommendations from the current assessment) and if that increase in maturity levels translates to measurable improvement in project performance.

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