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A CROSS-COUNTRY ANALYSIS OF LEAN CONSTRUCTION MATURITY IN JAPAN AND GERMANY USING THE LCMM

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ABSTRACT

Lean Construction Maturity Models (LCMM) have been proposed to provide organisations with a systemic and holistic overview of where they are on their Lean journey and how they can progress towards greater maturity. While previous work has focused mainly on European and American contexts, empirical evidence from Japan is scarce, despite Japan often being perceived as the "natural home" of Lean thinking. This paper reports on an exploratory, qualitative, international comparative study that applies the LCMM, structured around 11 key attributes, in Japan and Germany. It has employed a structured interview approach, hearing 21 experts in both countries. The findings suggest that Japanese projects, especially those delivered by large general contractors, exhibit relatively high maturity in terms of on-time delivery, right-first-time quality, routines, and kaizen, supported by culturally embedded concepts and long-term subcontractor relationships. German projects, in contrast, report lower plan stability and more frequent rework, but suggest emerging strengths in transparency, visual management, and novel commercial arrangements, such as IPD-like risk-sharing models. The paper concludes that the LCMM can serve as a useful structuring lens for cross-country Lean Construction maturity assessment, while maturity profiles remain strongly shaped by national culture, institutional context, and learning mechanisms.

KEYWORDS

Lean Construction, maturity model, benchmark, culture, continuous improvement.

INTRODUCTION

There is a growing consensus that implementing Lean Construction (LC) requires long-term and deep-rooted cultural change rather than merely the adoption of isolated tools and techniques. As organisations undertake this transformation, it becomes crucial to assess where they are on their Lean journey and to understand what a more mature Lean organisation looks like (Andersen & Jessen, 2003; Cooke-Davies, 2007). Maturity models provide such an assessment by describing stepwise stages of capability and behaviour and by offering guidance for prioritising improvement actions (CMMI Product Team, 2010; Wendler, 2012).

The Lean Construction Maturity Model (LCMM) was developed to integrate LC with maturity models, drawing on the structure of the Capability Maturity Model Integration (CMMI) and the EFQM Excellence Model (EFQM, 2012). The LCMM comprises five maturity levels,

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eleven Key Attributes and sixty Behaviours, Goals and Practices (BGPs) with associated Ideal Statements that describe what more mature organisations in LC are expected to exemplify (Nesensohn et al., 2014a; Nesensohn et al., 2015). Previous work has introduced and validated the LCMM and has argued that it "deconstructs and simplifies" LC by providing a common language about maturity and by distinguishing between immature and mature LC organisations (Nesensohn et al., 2014b). However, most empirical applications have focused on European or American settings, while insights from Japan are limited.

Japan is often regarded as the origin of Lean thinking, with concepts such as Kaizen, takt, pull and the reduction of mura, muri and muda being deeply embedded in industrial practice (Ohno, 1988; Liker, 2004; Kon et al., 2025). At the same time, the Japanese construction industry faces new challenges, including labour shortages, changing work regulations and increasing diversity on construction sites (Kon et al., 2025). Germany, in contrast, has a different institutional context, with highly fragmented project organisations, adversarial contracting traditions and a relatively recent uptake of LC methods on construction sites (Schöttle & Gehbauer, 2012; Schwarzweller & Haghsheno, 2024).

The paper extends previous LCMM work (Nesensohn et al., 2014a; Nesensohn et al., 2015) by applying the model in a Japanese context and by contrasting it with German cases. It provides empirically grounded maturity profiles for both countries and illustrates how the LCMM can be used to deconstruct and simplify cross-country differences in Lean Construction maturity. At the same time, this study does not assume that the LCMM functions as a culturally neutral measurement device whose attributes necessarily carry identical weight across national settings. Rather, the LCMM is used here primarily as a common structuring lens through which country-specific perceptions of maturity can be organised and interpreted. In this sense, RQ3 is intended less as a strict test of the LCMM's discriminative validity across countries than as an exploratory assessment of how far LCMM-based categories can support cross-country sense-making while still requiring contextual interpretation.

RESEARCH AIM AND QUESTIONS

The overall aim of this study is to investigate how Japanese and German practitioners and experts perceive LC maturity when assessed through the LCMM lens. Building on earlier work on maturity in LC and on the LCMM, the study addresses the following research questions (Nesensohn et al., 2014a; Nesensohn et al., 2015):

RQ1: How do interviewees in Japan and Germany characterise the current level of maturity in terms of LC outcomes, such as on-time delivery and right-first-time quality?

RQ2: How do they describe cultural and behavioural aspects of maturity, such as trust, psychological safety, routines, and Kaizen?

RQ3: How can expert perceptions of LC maturity in Japan and Germany be organised into cross-country patterns when interpreted through the LCMM as an exploratory structuring lens?

THEORETICAL BACKGROUND

Lean Construction Maturity and Maturity Models

Maturity models have become an established concept in many management-related disciplines, describing stepwise stages of capability and institutionalisation of processes (Wendler, 2012). The CMMI, in particular, has been influential, with its five maturity levels and its focus on process institutionalisation and continuous improvement (CMMI Product Team, 2010). In project-based sectors, maturity models have been adapted for project management, portfolio management, and construction processes, for example, in OPM3, P3M3 and SPICE (Sarshar et al., 1999; Project Management Institute, 2003; OGC, 2010).

In the LC domain, several authors have called for the combination of LC and maturity models in order to provide organisations with a structured route map towards more mature LC adoption (Perkins et al., 2010; Nesensohn et al., 2013). The LCMM translates the logic of the CMMI to LC by defining eleven Key Attributes—such as Lean Leadership, Customer Focus, Culture & Behaviour, Competencies, Improvement Enablers, Processes & Tools, Work Environment, Business Results and Learning & Competency Development—and linking them to Ideal Statements across five maturity levels ranging from 0-Uncertain to 4-Challenging (Nesensohn et al., 2014a). This enables a practitioner-led assessment based on observed behaviour, evidence, and actions rather than on self-reported tool usage (Nesensohn et al., 2015).

For the purposes of this paper, the LCMM is treated as a common comparative language rather than as a fully culture-free instrument. This distinction is important in a cross-country study, because national culture, institutional arrangements and industry structure may shape how specific LCMM attributes become visible in practice and how strongly they contribute to perceived maturity. Accordingly, the study assumes that the LCMM can support comparison across Japan and Germany, while also expecting that some attributes may be interpreted through context-specific "maturity substrates", such as long-term relational stability, collaboration norms or contractual fragmentation.

Immature and Mature Organisations in LC

Earlier LCMM work has conceptualised immature organisations as those characterised by heroic firefighting, ad-hoc problem-solving and the absence of stable routines and common language, while mature organisations display systematic processes, automatic behaviours, clear roles and responsibilities and an emphasis on continuous improvement (Paulk et al., 1993; Cooke-Davies, 2007; Nesensohn et al., 2014b). Mature organisations use data to guide decisions, actively develop competencies and embed Lean thinking into their "DNA" rather than merely applying tools (Nesensohn et al., 2014a; Nightingale & Mize, 2002). This study uses this mature/immature distinction as an interpretive lens for the interview data.

Beyond maturity models, the paper also draws on literature about collaboration and incentive structures in construction, as these are closely related to trust, psychological safety and cooperation—central aspects of LC maturity. Studies by Schöttle and colleagues have shown how collaborative procurement, risk/reward sharing and transparent decision-making processes can support Lean-consistent behaviour in projects (Schöttle & Gehbauer, 2012, 2013; Schöttle et al., 2014, 2018). These insights are particularly relevant when interpreting the German data, where new commercial arrangements are emerging as potential enablers of greater LC maturity.

METHODOLOGY

Research Design

The study adopts a qualitative, exploratory design, similar to the mixed-method approach used to develop and validate the LCMM (Morgan & Krueger, 1993; Nesensohn et al., 2014a; Nesensohn et al., 2015). Semi-structured expert interviews were conducted with practitioners and non-project experts in Japan and Germany, supported by a structured questionnaire that operationalised selected LCMM Key Attributes into concrete questions. The focus was on capturing how experienced key informants attach meaning to LC maturity in their particular context, which aligns with previous phenomenological work on LC maturity (Nesensohn, 2014).

Sample and Context

In total, 21 interviews were conducted: 10 in Japan and 11 in Germany. The sample includes academics with industrial backgrounds, non-project experts within the industry, and project practitioners such as site managers, product engineers and senior chief experts, predominantly

from large general contractors, owners and joint ventures. This reflects the LCMM logic of focusing on key informants with substantial LC experience who can comment on maturity at organisational and project levels (Nesensohn et al., 2014a). The Japanese sample also includes a comparatively strong concentration of interviewees linked to one major general contractor. This concentration was considered appropriate for an exploratory study of advanced LC practice, but it also means that the Japanese profile should be interpreted with caution: it may partly reflect the maturity characteristics of a highly developed organisational cluster rather than a statistically representative profile of the Japanese construction industry as a whole.

Table 1: Profile of the interviewees

Code	Institution	Role	Experience
JP-1	General Contactor A	Senior Researcher	10 years
JP-2	General Contactor A	Senior Chief Expert (Construction Planning)	17 years
JP-3	University X	Professor (Department of Architecture)	N/A
JP-4	University Y	Professor (Department of Architectural Engineering)	N/A
JP-5	University Y	Professor (Department of Industrial Engineering)	N/A
JP-6	General Contactor A	Project Manager	19 years
JP-7	General Contactor A	Project Manager	33 years
JP-8	General Contactor A	Chief Expert	13 years
JP-9	General Contactor A	Group Lead	19 years
JP-10	General Contactor A	Senior Researcher	9 years
GE-1	General Contractor B	CEO	35 years
GE-2	General Contractor C	Senior Manager	25 years
GE-3	General Contractor D	Branch Manager	20 years
GE-4	General Contractor E	Senior Lean Management	15 years
GE-5	General Contractor F	Senior Manager?	25 years
GE-6	General Contractor E	Senior Manager?	25 years
GE-7	General Contractor E	Lean Manager?	37 years
GE-8	General Contractor F	Senior Manager?	16 years
GE-9	Owner / Programme JV	Programme Director	35 years
GE-10	Owner Representative	Construction Manager	15 years
GE-11	General Contractor H	Senior Expert	42 years

Data Collection

The interview guide was derived from the LCMM Key Attributes and related Ideal Statements, while ensuring that the questions remained understandable for non-specialists (Nesensohn et al., 2014a; 2015). Core topics included:

- On-time delivery, deviation frequency and right-first-time quality
- Trust and psychological safety
- Routines and waste and the impact of Lean training
- Updating of production plans, cooperation and contracts
- Visual Management, cycle time and the use of takt, flow and pull

All interviews followed the same basic structure, starting with the interviewee's role and experience, then moving through standardised Likert-type questions (mapped to LCMM dimensions) and open probes for examples and narratives. The Japanese interviews were conducted in English with interpretation where necessary and were fully transcribed. The German interviews were conducted in German, transcribed and translated where relevant for cross-case comparison.

Data Analysis

The analysis combined a descriptive numerical overview with thematic coding, consistent with the framework method used in earlier LC maturity research (Ritchie et al., 2003; Nesensohn et al., 2014b). First, the numerical ratings from the Excel sheet were summarised by interview type and country to create an initial maturity profile across the LCMM-related variables. Second, the interview transcripts were analysed thematically, using a framework approach based on the LCMM Key Attributes and additional emergent themes such as labour regulation, joint ventures and digitalisation. Coding was carried out by the first author using a framework derived from the LCMM Key Attributes and was iteratively refined while moving between the data and the literature (Ritchie et al., 2003; Nesensohn et al., 2014b). To address RQ3, numerical responses from the structured questionnaire were summarised by country across the LCMM-related dimensions and then read together with the coded interview material. For each LCMM Key Attribute, the descriptive distribution of Likert-type answers and the dominant themes in the narratives were combined into an overall judgement of relative maturity. These judgements are expressed as the verbal categories in Table 2 (e.g. High, Medium-High, Medium, Low-Medium, Emerging/Medium) and should be understood as interpretive summaries consistent with the exploratory character of the study rather than as precise measurement scores.

RESULTS

Key Finding 1: On-Time Delivery and Plan Stability

The Japanese range 85–95%, with several experts referring to category four on a five-point scale. Interviewees attribute this relatively high performance to a long history of know-how accumulation in large general contractors, strong subcontractor relationships and a deeply rooted sense of responsibility for meeting commitments. One non-project expert described the baseline of the industry as “quite high”, expressing amazement at how complex projects are delivered within time, cost and quality constraints in dense metropolitan environments.

At the same time, Japanese interviewees report that plan accuracy is under pressure from recent regulatory and environmental changes. Changes to working-time regulations, intended to be balanced by productivity gains from digital technologies, have in practice led to reduced overtime without fully realised efficiency improvements, thereby decreasing plan accuracy. In addition, interviewees cite unpredictable storms, heat-related work stoppages and late design changes as primary causes of schedule deviations, emphasising that delays are often due to external factors combined with limited buffers rather than workers’ lack of capability.

German interviewees paint a different picture. They report frequent deviations from plans driven by planning quality issues, missing preparatory work, and constant design changes that “tie up a lot of resources due to constant replanning”. Plan reliability is generally rated lower than in Japan, with causes located predominantly in coordination, communication and the misalignment of interests between multiple project participants rather than in external conditions. One respondent summarised the situation as “no collaboration between the parties involved” and highlighted that production planning is often missing or not used consistently.

These findings suggest that, in LCMM terms, Japanese cases tend to reach higher maturity levels on the dimensions related to on-time delivery and planning stability, whereas German cases remain closer to the “Awakening” or “Systematic” levels, with substantial variability between projects (Nesensohn et al., 2014a; Nesensohn et al., 2015).

Key Finding 2: Right-First-Time Quality

In Japan, right-first-time (RFT) quality is typically assessed in the range of 85–95%, with some interviewees estimating RFT above 95% in their projects. Minor rework is acknowledged but is described as being within a small share of the total work, often related to complex

first-of-a-kind solutions or interface issues rather than systemic quality problems. The presence of third-party quality inspectors and strong in-house quality management functions in large contractors is cited as a key factor supporting high RFT performance.

In Germany, interviewees point to recurring quality deviations such as tolerances, unevenness and optical damage, alongside incomplete preparatory work for successor trades. These issues often require rework and are perceived as part of the "normal" project experience. While some respondents note improvements in specific Lean pilot projects, the overall RFT maturity is lower and more heterogeneous than in the Japanese cases.

From an LCMM perspective, Japanese organisations appear closer to the "Integrated" level on the Business Results Key Attribute, where right-first-time performance is achieved more or less automatically, whereas German organisations are still working towards consistent systematic practices (Nesensohn et al., 2014a).

Key Finding 3: Trust and Psychological Safety

Trust between project parties is perceived differently in the two countries. Japanese interviewees describe trust as being, to some extent, taken for granted within long-standing relationships between general contractors and subcontractors, especially in major metropolitan regions where subcontractors "know how the General Contractor X operates and vice versa". Trust is also inferred from the behaviour of clients: when owners do not need to visit the site frequently and continue to award new projects, this is interpreted as an expression of confidence in the contractor's capabilities.

At the same time, interviewees are aware that this implicit trust can be challenged when owners have less understanding of construction or when complex joint ventures with several large contractors and multiple design stakeholders are formed. In such contexts, the perceived trust level can vary significantly, and gaps in understanding of roles and responsibilities become more visible.

Psychological safety in Japan is described as being in transition. Historically, strong collective socialisation and stable hierarchies meant that people "understood each other without saying a word", creating a predictable environment but also limiting explicit conversations about problems. With increasing diversity on construction sites, including more foreign workers and changing values, interviewees report a mix of environments: in some projects, it has become easier to raise issues due to heightened awareness of harassment and worker wellbeing, whereas in others, the traditional hierarchical premises still dominate.

In Germany, trust is frequently highlighted as a critical bottleneck. Interviewees refer to "lack of trust" and purchasing behaviours that undermine collaboration, with clients and contractors often pursuing short-term gains rather than joint project success. Psychological safety is ambivalent: Lean-enabled meetings and workshops can create transparent, blame-free spaces where "all participants can talk openly about problems", but outside these settings, respondents describe continued fear of blame and reputation loss.

Within the LCMM, these observations relate directly to the Culture & Behaviour and Customer Focus Key Attributes and support earlier findings that trust and psychological safety are central differentiators between immature and mature LC organisations (Nesensohn et al., 2014b; Schöttle & Gehbauer, 2012).

Routines, Kaizen and Waste Identification

Japanese interviewees report a dense network of routines and Kaizen practices. Daily morning meetings of around 30 minutes, mid-day 11:30 meetings with foremen and weekly reflection sessions at the beginning of the week are described as standard practice on many projects. Kaizen activities are reported to occur daily or at least weekly, with one academic noting that "mura and muda are embedded in our culture" and that people "always think about waste". Structured Kaizen is used both at site level and in office environments, with examples such as

visualising tasks previously communicated only verbally, to turn them into material for discussion and improvement.

The identification and elimination of waste is perceived as frequent and systematic, with some interviewees highlighting that the biggest waste is "not learning from failures" and not leveraging them as resources for future improvement. Others point to over-engineering and overthinking as specific forms of waste, reflecting a cultural tendency to "do too much" in pursuit of perfection.

German interviewees recognise significant waste in the form of waiting times, idle periods on sites, and repetitive planning and re-planning cycles. Several respondents argue that the industry should "focus more on standardisation rather than constantly reinventing the wheel". However, they also indicate that structured routines for continuous improvement are often missing or limited to specific Lean interventions, rather than being part of the everyday way of working.

These differences mirror the LCMM observation that more mature organisations institutionalise learning and continuous improvement across all levels, whereas immature organisations rely on ad-hoc initiatives and individual "heroic" efforts (Nightingale & Mize, 2002; Nesensohn et al., 2014a).

Key Finding 4: Visual Management and Transparency

In Japan, Visual Management is widely used but displays varying levels of sophistication. Common practices include colour-coded drawings to show which areas are completed or in progress, location-based boards, digital boards on site and BIM-supported progress visualisation. Some projects use advanced visual dashboards, such as Power BI-based reports, while others rely on simpler visual tools. Interviewees distinguish between "visualising" information and practising "Visual Management" as a deliberate management system, noting that the latter is not yet uniformly implemented.

German interviewees describe the use of Visual Management mainly in Lean pilot projects or in the context of Last Planner implementations. Examples include marked logistics areas, visual boards for commitments and constraints and simple on-site boards for daily coordination. Outside these contexts, the visualisation of progress, constraints and responsibilities is described as sporadic and non-standardised.

Within the LCMM, these observations speak to the Processes & Tools and Work Environment Key Attributes and reinforce the argument that visual tools alone are not sufficient unless they are embedded into a coherent management system (Nesensohn et al., 2015; Kon et al., 2025).

Key Finding 5: Takt, Flow and Pull

Japanese interviewees see takt, flow and pull as elemental parts of the planning system, although not always labelled with these terms. Rolling planning structures with long-term, mid-term, weekly and daily plans are common, and daily revisions of the plan are used to reconcile planned and executed work, similar to Last Planner concepts (Ballard & Howell, 1998). Takt-based coordination is supported by regular meetings, and some interviewees report that takt planning has been clarified and deepened through recent training initiatives.

However, the picture regarding pull is more nuanced. Some respondents describe an intuitive mix of push and pull, where teams start with a push-style schedule and then introduce more pull-based logic when it becomes clear that the initial plan cannot be met. Others emphasise that pull planning, as understood in LC theory, is "not well understood" or not consistently practised across all projects.

German interviewees emphasise the need for takt and standardisation and report successful experiences with takt and flow in selected projects, especially in repetitive environments such as housing or standardised building types. At the same time, they note that many projects still

lack a proper production planning approach, with overlapping trades, unclear sequences and insufficient integration of subcontractors into the planning process.

These findings align with broader LC literature, which stresses that production system design and the integration of takt and pull are key levers for improving reliability and flow (Koskela & Ballard, 2012; Kon et al., 2025).

Key Finding 6: Impact of Lean Training

In Japan, Lean and takt trainings are reported to have varying impacts depending on the participants' prior experience and the extent to which training is linked to real project practice. Some interviewees report that takt training significantly changed their understanding of how to plan, shifting from a simplistic repetition of activities floor by floor to an integrated, resource-aware takt approach. Others note that many Lean concepts felt "obvious" and familiar, but that training helped to package and articulate them in a structured way.

German interviewees frequently criticise Lean training as being too generic and not sufficiently project-related, which makes it difficult for participants to apply the knowledge in their everyday work. They emphasise that without continuous coaching, dedicated facilitation and integration into project routines, the behavioural impact of training remains limited, leading to what some view as "knowledge islands" rather than organisation-wide maturity gains.

These insights are consistent with maturity and transformation literature, which emphasises the role of targeted capability development and sustained support in moving organisations up the maturity ladder (Perkins et al., 2010; Ricardo & Alarcón, 2014).

DISCUSSION

INTERPRETING MATURITY PROFILES THROUGH THE LCMM

The cross-country findings suggest that the LCMM provides a useful lens for interpreting differences in LC maturity, while also showing that maturity profiles are shaped by distinct cultural and institutional conditions. In this paper, Table 2 should be read as a condensed interpretive summary of broader empirical patterns rather than as a precise or culture-neutral measurement output. The Japanese cases indicate relatively high maturity in Key Attributes such as Culture & Behaviour, Competencies, Improvement Enablers, Processes & Tools and Work Environment, especially in relation to routines, Kaizen, right-first-time quality and on-time delivery. This is consistent with the idea that more mature organisations display habitual behaviours, systematic processes and a strong culture of continuous improvement (Nesensohn et al., 2014a; Nightingale & Mize, 2002).

Table 2: LCMM-based maturity assessment for Japan and Germany

LCMM Key attributes	Japan	Germany
Business Results (On-time delivery, Right-first-time quality)	High	Medium
Culture & Behaviour (Trust, Psychological safety)	Medium-High	Low-Medium
Improvement Enablers (Kaizen, Lean training impact)	High	Low-Medium
Processes & Tools (Takt/flow/pull, Visual Mngt, Cycle time, Routines)	Medium-High	Medium
Cooperation & Contracts (Cooperation, Contract forms)	Medium	Emerging/Medium
Change & Learning (Production plan updates, Learning culture & Kaizen)	Medium	Medium

German cases, in contrast, reveal lower and more variable maturity in these dimensions but exhibit emerging strengths in transparency, Visual Management and the development of new contractual and cooperative arrangements, such as IPD-like models that share risk and rewards between clients, designers and contractors. These elements relate to LCMM Key Attributes such as Customer Focus, Cooperation & Contracts and Change, suggesting that German

organisations may be experimenting with structural enablers of maturity even if day-to-day routines have not yet caught up (Schöttle & Gehbauer, 2013; Schöttle et al., 2018).

Overall, the data support earlier LCMM work, which argued that maturity in LC is not primarily about the number of tools applied but about how far Lean philosophy, behaviours and routines are embedded into the organisation's way of thinking and acting (Nesensohn et al., 2014b; Nesensohn et al., 2015).

CULTURE, INSTITUTIONAL CONTEXT AND LEARNING MECHANISMS

The findings also highlight that maturity is not only a matter of tools and processes but is deeply connected to local culture and institutional frameworks. In Japan, concepts like mura and muda, community roles and long-term relationships with subcontractors create a context in which responsibility, continuity and incremental improvement are natural starting points for LC maturity (Kon et al., 2025; Liker, 2004). However, this implicit basis is now being challenged by labour regulations, increasing diversity and complex joint ventures, which require more explicit mechanisms for trust, psychological safety and collaborative decision-making.

In Germany, the institutional context of fragmented project organisations, adversarial contracting and strong legal formalism has historically undermined trust and created incentives for local optimisation rather than joint value creation (Schöttle & Gehbauer, 2012; Schwarzweller & Haghsheno, 2024). Lean interventions and LCMM-aligned initiatives must therefore address not only routines and tools but also procurement, contracts and leadership behaviours that enable collaboration and shared risk (Schöttle et al., 2014; Salam et al., 2019).

Learning mechanisms differ as well. Japanese organisations often leverage daily and weekly routines, as well as Kaizen and formal reports, to institutionalise learning, but some interviewees caution that the full potential of learning from failures is not yet realised. German organisations, on the other hand, often rely on time-boxed trainings and project pilots, which can generate local success but may not systematically reconfigure organisational routines and mindsets (Nesensohn, 2014; Ricardo & Alarcón, 2014).

IMPLICATIONS FOR USING THE LCMM

The study suggests several implications for the application and further development of the LCMM. First, LCMM-based assessments in Japan may usefully pay particular attention to Key Attributes such as Trust, Psychological Safety, Customer Focus and Learning & Competency Development, as these are areas where implicit cultural assumptions are being challenged and where maturity appears to be in flux.

Second, LCMM applications in Germany may prioritise Improvement Enablers, Contracts & Cooperation, Change and Processes & Tools in order to support movement from isolated pilots towards more systematic and integrated maturity gains (Nesensohn et al., 2014a; Schöttle & Gehbauer, 2013). Given the exploratory design and purposive sampling, these implications should be read as indicative rather than prescriptive country-level recommendations.

Third, the findings reinforce the need for practitioner-led assessments by experienced Lean experts who can interpret evidence in its context rather than relying on self-assessment checklists. The complexity of cross-country comparisons and the risk of "toolism" require assessors who understand both LC theory and the local realities of project delivery (Nesensohn, 2017).

CONCLUSIONS

This paper explored how Japanese and German experts perceive LC maturity when assessed through an LCMM-informed interview framework. The study adds to the growing body of knowledge on LC maturity by providing empirically grounded maturity profiles from two

distinct contexts and by illustrating how the LCMM can be used as a deconstructing and simplifying device to structure such profiles (Nesensohn et al., 2014a; Nesensohn et al., 2015).

The findings show that Japanese projects, especially those delivered by large general contractors, display relatively high maturity in on-time delivery, right-first-time quality, routines and Kaizen, underpinned by cultural concepts and long-term relationships. At the same time, they face new challenges related to labour regulations, diversity and complex stakeholder constellations, which require more explicit approaches to trust, psychological safety and collaboration. German projects, in contrast, struggle more with plan stability and rework but show promising developments in transparency, Visual Management and collaborative commercial models, which can be seen as stepping stones towards greater LC maturity (Schöttle & Gehbauer, 2013; Schwarzweller & Haghsheno, 2024).

The study is exploratory and limited by its qualitative scope and purposive sampling from Lean-oriented organisations, including a strong representation of one major Japanese contractor. The findings, therefore, reflect expert perspectives from large contractors already engaged with Lean Construction and do not statistically represent the wider construction industry in either country. More systematic case study research and quantitative LCMM assessments across a broader set of organisations and countries are needed to confirm and refine the emerging patterns (Wendler, 2012; Nesensohn, 2017). In addition, the study suggests that culturally embedded "stability substrate" mechanisms – such as long-term relational continuity, shared routines or implicit coordination norms – may not be fully visible through LCMM attributes as operationalised here.

Future research should therefore replicate the study across a broader range of Japanese and German organisations, test inter-rater reliability in the LCMM-based mapping, and use mixed-method validation to examine whether the maturity profile differentiation shown in Table 2 becomes more robust with larger and more diverse datasets (Wendler, 2012; Nesensohn, 2017).

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