

LEAN CONSTRUCTION IN GERMANY – EMPIRICAL FINDINGS ON THE CURRENT STATE OF PRACTICE

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ABSTRACT

In recent years, Lean Construction has gained notable popularity in Germany and is now used by companies in all areas along the supply chain in the construction industry. This study provides an overview of the current state of Lean Construction practice in Germany. Using a three-phase approach, 451 companies that use Lean Construction were first identified through a comprehensive industry analysis. Subsequently, 15 interviews with experienced practitioners were conducted to understand the common Lean Construction practices and their perceptions of the industry. The insights derived informed a survey, which was sent to the identified companies. A total of 97 participated. Findings reveal that Lean Construction is still predominantly applied during the execution phase, although an increasing number of companies are gaining experience in the planning phase. However, the adoption remains limited across the industry, with only a few companies achieving high maturity while most use Lean Construction on a small scale. Primary barriers to company-wide integration include a lack of expertise and the substantial time commitment required. Thus, success depends on the “right” application, which, when achieved, generally leads to positive project outcomes.

KEYWORDS

Lean Construction, Practice, Lean Methods, Construction Industry, Germany.

INTRODUCTION

Over the past decades, research on Lean Construction has continued to grow worldwide, as evidenced by the widening range of research topics, the rising number of publications, and the increasing diversity of participating countries. In Germany specifically, Lean Construction has been the subject of academic investigation for 22 years (WEINMANN et al., 2025). About a decade ago, the founding of the German Lean Construction Institute (GLCI) also led to a broader practical adoption of Lean. Since then, however, the number of projects and companies that have made significant efforts to implement Lean Construction has been limited.

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Today, the GLCI is the largest forum for exchange among practitioners, and between academia and the industry. Beyond GLCI activities, many training programs focusing on Lean have emerged in recent years. Since the launch of the first Lean Construction lecture in 2004 at Karlsruhe Institute of Technology (GEHBAUER, 2018), university curricula – particularly in Civil and Industrial Engineering programs – have also widely incorporated the topic.

Despite these developments and a growing general awareness of Lean Construction in practice, impressions gathered at conferences and in discussions with various practitioners suggest a discrepancy: research is often perceived to be diverging from day-to-day industry concerns, driven by ever-increasing specialization. Concurrently, a disparity emerges within the industry itself: some companies have extensive Lean experience, while others are just beginning – or have yet to begin – their Lean journey. Even among stakeholders who are aware of Lean, many remain uncertain about what the approach really stands for, what distinguishes “Lean practitioners” from conventional practitioners, and what the benefits of Lean actually are. To some, it may still appear primarily as a marketing tool. In light of these observations, this study investigated the current state of Lean Construction practice in Germany, aiming to identify the advancement of companies that have adopted Lean and the overall diffusion in the industry. Germany’s distinct regulations, language, cultural and structural specificities warrant a country-specific focus, just as other studies have done for different national contexts.

By clarifying the current state, this study seeks to bridge research and practice. First, researchers may benefit by more accurately aligning future investigations with practical needs. Second, companies can better judge their own level of advancement relative to the national landscape and benchmark themselves against the latest developments. Such a foundational study has been lacking in Germany. Alongside general indicators (e.g., percentage of projects using Lean, common implementation challenges, and methods in use), the results of this study should help in the endeavor to better understand the national practice of Lean Construction.

This paper, therefore, is structured as follows. First, it provides an overview of comparable (inter)national studies that influenced this study. Next, it outlines the research methods, the data and discussion of the study, which begins with an overview of the German construction industry (Phase 1), continues with assessments from practitioners (Phase 2), and culminates in findings from a nationwide survey (Phase 3). The paper concludes with a summary of the results.

RESEARCH ON LEAN CONSTRUCTION ADOPTION

The first study investigating Lean Construction adoption in Germany was conducted by JOHANSEN and WALTER (2007), who focused exclusively on the contractor side. They contacted 61 of the largest German construction firms, of which only 17 responded. The findings revealed that, in the mid-2000s, there was negligible awareness and even less application of Lean. A decade later, DLOUHY et al. (2017) interviewed eight German client organizations regarding their integration of Lean principles and methods. The findings indicated that these companies were at highly varied levels of maturity and that Lean remained generally in an early implementation stage. BACKHAUS and DAHM (2020) arrived at similar conclusions in their study of 14 contractor firms. Through interviews, the researchers assessed which of Lean characteristics were implemented by each company. While some companies displayed partial adherence of some characteristics, many typical characteristics were either unaddressed or underemployed, suggesting a generally low-to-moderate maturity level among this sample. The study also observed that larger and more specialized companies were more likely to engage with the Lean approach, although a broad culture of mistrust – partly fueled by strict liability regulations – remains a significant barrier to collaboration and therefore the adoption of Lean Construction in general. Beyond these works, no other studies on Lean Construction in the German context exist. It is evident that each of these three studies examined a relatively narrow segment of the construction industry, a factor which served to limit their generalizability.

Internationally, several studies have investigated Lean Construction practice in countries such as Brazil and the United States (ALVES et al., 2012), Abu Dhabi (AL-AOMAR, 2012), Norway (MALVIK et al., 2024), India (SINGH et al., 2023), Ireland (EBBS et al., 2015) and many more. However, these studies vary considerably in quality, methodological approach, and thematic focus. Often, these studies focus on the barriers to implementing Lean on an industry-wide scale, while some aim to assess the extent to which Lean is universally understood in practice. Overall, these studies suggest that, in most national contexts Lean remains in an early stage of adoption. It is far from being widely implemented across the construction industry.

Methodologically, previous research has used a variety of approaches such as surveys, interviews, case studies, or mixed-method designs. Yet none appear to have attempted to systematically identify the “Lean companies” in their industry. However, this poses the risk of an unbalanced data set, especially if multiple participants from the same company are included.

ANALYSIS OF THE CONSTRUCTION INDUSTRY (PHASE 1)

BACKGROUND AND CONTEXT

This study introduces a novel approach: rather than immediately analyzing current practices, as comparable studies have done so far, the objective is to first identify who is actually applying Lean in the construction industry and thereby define the “population” of Lean practitioners.

A logical starting point for this effort was the database of the German Lean Construction Institute (GLCI), which, as of January 2025, listed 174 corporate members. However, our experience indicates that numerous companies applying Lean Construction are not registered with the GLCI. Therefore, we conducted an extensive analysis of the German construction industry to identify as many “Lean companies” as possible. The results of Phase 1 thus provide a solid foundation for the subsequent phases and strengthen the validity of our findings.

RESEARCH METHOD

Building on the approach developed by HAGHSHENO and JOHN (2024), which identified (almost) all companies offering client-side project management in Germany through a comprehensive market study, we conducted the analysis via desk research. Consequently, all collected data are derived from publicly accessible sources. In a Design Thinking workshop (BROWN, 2008), four search strategies were devised to identify companies in Germany using Lean Construction:

1. **GLCI Registers (members and conference participants):** Company memberships or conference participation in the GLCI may signal at least an interest in Lean Construction. Given that such interest is not definitive proof of Lean application, each company identified through GLCI registers was further investigated to confirm actual usage.
2. **Corporate Websites:** The assumption was that companies feature Lean Construction in their service portfolios, project references, or corporate descriptions. Hence, we divided Germany into smaller geographic units – specifically the 16 federal states as well as the major cities (A, B, C, and in some cases D cities⁵) – and performed keyword searches on Google (e.g., “Hamburg AND Lean Construction OR Last Planner OR ...”). A total of 1,230 keyword searches were executed, examining 6,543 Google pages of results. Every company was screened for references to Lean or closely related terms. Only those providing clear evidence of application were retained in the data set.

⁵ This classification categorizes German metropolitan areas/cities from A to D based on their significance in the real estate market. The seven A-cities are the most prominent centers, with both national and partial international influence. The 14 B-cities are significant at the national and regional levels, while the 22 C-cities have limited national relevance but hold high regional importance. Finally, the 84 D-cities exhibit restricted regional significance and therefore account for a smaller overall market volume.

However, preliminary tests revealed that some companies do not publicly advertise their use of Lean Construction, prompting additional research strategies:

3. **Job Advertisements on Job Portals:** Some companies express a need for Lean Construction experience in their job postings. Such advertisements thus serve as indicators that a company actively uses Lean Construction.
4. **LinkedIn Job Titles:** Job titles like “Lean Manager” or job descriptions in employee profiles can also point to an engagement with Lean Construction.

For each identified company working with Lean Construction in Germany, we collected various data: contact person, main office address, and the number of locations (to assess company size). We also reviewed the service portfolios and corporate descriptions to classify the areas of expertise in which each company operates. By adopting this approach, we were able to identify those companies that consciously engage with Lean and communicate their use. Consequently, companies that may employ Lean but have not provided any public evidence were not captured.

FINDINGS AND DISCUSSION

As a result of our investigation, we identified 451 companies in Germany that apply Lean Construction⁶ – an impressively large number from our subjective viewpoint. Despite the considerable search effort invested in Phase 1, it remains possible that some companies went undetected; nevertheless, the authors consider the set of 451 to be sufficiently representative.

Evaluating the diffusion of Lean Construction across the industry is challenging without precise data on the total number of companies active in the German construction industry. While no official figures exist, a rough estimation can be derived from various statistics that encompass the primary construction trades and finishing sectors, as well as architectural and engineering companies, consultancies, and client representatives/project management providers. An artificial intelligence-driven analysis of the available data has estimated that there are more than 300,000 construction-related companies in Germany. Consequently, the identified 451 “Lean companies” represent <1% of the overall construction industry, indicating considerable scope for further expansion. It should be noted that our data do not account for companies that may have previously worked with Lean Construction but discontinued its use.

By analyzing the company size and their areas of expertise, a categorization of the “Lean companies” was established. Notably, 55% of the companies have more than one location, and 33% have more than five. Given the highly fragmented nature of the German construction industry – characterized by a predominance of small enterprises (80–95% of all firms in the industry (KRAUS & WEITZ, 2024; HAGHSHENO & JOHN, 2024)) typically operating from a single location – this statistic suggests that Lean is disproportionately adopted by larger companies.

In terms of areas of expertise, Lean Construction was found to be used by companies across all areas of the construction supply chain. However, client organizations (3%) were underrepresented, likely because they rarely disclose details about their projects, unlike service providers. Companies with expertise in construction logistics (6%) and supply (11%) were also underrepresented. Conversely, companies in construction management (42%), construction work (35%), and client representation (33%) were the areas with the highest representation. This analysis suggests that Lean has achieved diffusion across all major areas of expertise in the construction industry. This represents a significant shift from earlier years, when it was used almost exclusively in the execution phase (well-documented in the research from 2003 to 2013).

Beyond the 451 identified companies, our search also revealed 42 software providers (excluded from the total of companies because they are only indirectly part of the construction

⁶ 162 were initially used from the GLCI Register (Strategy 1), then 168 were found via Strategy 2 (Corporate Websites), 62 via Strategy 3 (Job Advertisements) and 59 via Strategy 4 (LinkedIn Job Titles).

industry), 42 universities incorporating Lean Construction into their curricula, and 64 professional training institutes offering related courses. The number of these organizations underscores the broader ecosystem supporting Lean Construction in Germany.

(SELF)ASSESSMENT OF THE INDUSTRY (PHASE 2)

BACKGROUND AND CONTEXT

In order to gain deeper insight into how Lean Construction is being applied in practice, 15 interviews were conducted with experienced practitioners from various disciplines (all from the identified companies). Each interviewee was first asked to describe and assess the Lean practices within their own company, then to evaluate the current state of other Lean adopters throughout the industry – therefore we have taken a broad and overarching perspective here. The primary aim was to record how much Lean the companies are doing in their projects, how long they have been working with it, what successes have been achieved and whether Lean is also apparent outside of projects. The consolidation of these perspectives provided an initial overview of both the nature of Lean application and the industries' overall advancement.

RESEARCH METHOD

To capture diverse perspectives, we employed a purposeful sampling strategy, targeting individuals who met two key criteria: (1) substantial Lean Construction experience (based on the number of years and projects in which they had applied some form of Lean) and (2) broad industry knowledge – see Table 1. This approach aimed to ensure that the interviewees could offer both depth (deep familiarity with Lean) and breadth (insights into broader industry trends).

To determine an appropriate sample size, we applied the principle of thematic saturation, concluding interviews once little new information emerged. We thereby used a semi-structured questionnaire composed of both open-ended questions and propositions derived from the authors' experience and a literature review. All interviews took place via videoconference, were recorded for accurate analysis, and typically lasted around 60 minutes. The interview notes were subsequently expanded by repeatedly reviewing the recordings. Finally, the underlying structure of the questionnaire was used to organize the responses, thereby enabling a clear presentation of the participants' viewpoints and facilitating a discourse on the various topics.

Table 1: Profiles of Interviewed Practitioners

(Primary) Area of Expertise of the Practitioner Company	Experience in Construction (in Years)	Experience with Lean Construction (in Years)	Number of Lean Projects Overseen (Estimation)
Client	10	10	65
Client	19	11	300
Project Manager	10	10	10
Project Manager	12	10	100
Planner / Contractor	11	8	50
Planner / Contractor	13	9	90
Planner / Contractor	28	12	200
Contractor	13	13	300
Contractor	28	9	100
Lean Consultant	7	7	50
Lean Consultant	26	9	10
Lean Consultant	15	7	50
Lean Consultant	26	15	220
Lean Consultant	15	14	60
Education	24	5	-

FINDINGS AND DISCUSSION

The practitioners unanimously reported that the use of Lean has positively impacted project performance. However, they noted that not every project with Lean is automatically successful. The extent to which Lean Construction influences a project's success depends on several factors:

- **External Influences:** The dynamic nature of construction projects means unforeseen events can occur, potentially derailing a project despite efficient management practices.
- **Degree of Implementation in the Project:** Lean is often not integrated holistically throughout an entire project or among all participants. Instead, it is applied only by a subset and only for specific phases: Lean is still predominantly observed in the execution phase (also seen in other countries, e.g. SARHAN et al. (2017)). The Lean consultants noted that many of their assignments were "firefighting" – meaning that Lean was first integrated when the project was already in trouble (not in the beginning).
- **Strength of Utilisation:** In many cases, only select Lean methods are applied, while the overall project delivery remains traditional – also called "Lean light". While this limited implementation may improve individual areas, it often fails to impact the overall project success, which remains influenced by other management practices.
- **Quality of Execution:** Many practitioners emphasized that Lean must be implemented correctly to achieve its potential. Challenges include poorly structured Lean initiatives or active resistance from parts of the project team. The practitioners highlighted that resistance often arises because projects labelled as "Lean" may not truly embody Lean principles, thereby leading to mistrust. As a result, change management is critical when introducing Lean, as resistance usually also prevails when Lean is correctly introduced.

This poses also a significant risk to the **acceptance** of Lean Construction in the whole industry and thus hinders the general diffusion (as well as the following highlighted aspects). As one practitioner summarized: "Lean requires both sufficient **time** and **workforce**, as well as **adequate expertise**." For smaller companies, the financial burden for proper onboarding, combined with the day-to-day workload, often hinders engagement with Lean practices. On a broader industry level, practitioners noted that despite the growing awareness of Lean in recent years, many construction professionals are still unfamiliar with the approach. The necessity for a cultural transformation in accordance with Lean often fails due to **deep-rooted structures and practices** within companies and the industry (BACKHAUS & DAHM, 2020).

However, when considering the future, there are reasons to be optimistic. Practitioners noted that Generation Z (born after 1995), is changing company dynamics. This generational shift may create more fertile ground for Lean. Especially as Lean is increasingly embedded in the curricula of universities, making it a familiar concept for many new industry entrants.

One other noteworthy observation shared by several practitioners is that aspects of Lean Construction are already being implemented in some projects without being explicitly labelled as "Lean". These practices may be traced back to alternative but similar approaches, such as Agile Management (JOHN et al., 2025). However, this sometimes leads to the perception of Lean as an "old wine in new bottles" or as "common sense." Therefore many practitioners expressed a desire for initiatives to demystify Lean Construction, making its principles and advantages clearer and differentiating it from traditional practices more obvious.

NATIONWIDE SURVEY (PHASE 3)

BACKGROUND AND CONTEXT

After identifying the majority of 'Lean companies' in Germany during Phase 1, and gaining insights into Lean application in Germany through the perspective of industry experts in Phase

2, Phase 3 involved reflecting on these findings through a nationwide survey – providing a comprehensive understanding of the current state of Lean Construction practice in Germany.

RESEARCH METHOD

In order to gain a comprehensive understanding of the current state of practice, we opted for a standardized, web-based survey. The survey design incorporated insights from the expert interviews conducted in Phase 2 as well as findings from existing research literature on Lean Construction – e.g., the use of common Lean methods, as outlined by BABALOLA et al. (2019).

The design of the survey questions and response options followed the established recommendations from methodological research (SCHNELL et al., 2018). Once the survey content was finalized, it was implemented on an online platform, following guidelines from DILLMAN (1978) and BRAUNECKER (2023). 10 pretests, combined with follow-up interviews, were conducted to validate the survey for content completeness, clarity, time feasibility, and technical functionality. The pretests included participants from the target population and individuals from academia. These tests were carried out sequentially, with modifications incorporated after each round. After completing the pretests, the survey was finalized.

The survey was conducted anonymously to mitigate response biases, such as social desirability effects, and to encourage participation (SCHNELL et al., 2018). It comprised 15 questions (five focusing on company characteristics and ten addressing the current state of Lean application) and 15 propositions for evaluation (derived from the experts' assumptions in phase 2). The responses were analysed at the company level, ensuring that each of the participating companies was represented only once. This approach avoided excessive distortion of results that could occur if multiple individuals from the same company participated. To ensure this, the survey was sent to a single representative of each of the companies who had a comprehensive understanding of their company's activities, particularly with respect to Lean practices. Participants were explicitly instructed to complete the survey only once per company.

FINDINGS AND DISCUSSION

The results of the survey presented below are considered highly valid, as the companies identified in Phase 1 cover a significant portion of “Lean companies” in Germany, and all areas of expertise were sufficiently represented among the responding companies. The survey also achieved a high response rate of 22 % (97 responses out of 451 companies contacted), which in our experience is above average for surveys of this type. Due to the limited scope of this conference paper, only selected results are (graphically) presented. For access to the complete findings, interested readers are encouraged to contact the lead author.

The 97 participating companies represent all areas of expertise in the construction industry, with the majority associated with execution (44%), client-side project management (37%), construction management (29%), as well as architecture (26%). Respondents also included consultants (22%), planning coordinators (20%), and specialized planners (20%). Clients (13%), developers (12%), construction logistics providers (9%), and suppliers (4%) were the least represented. Additionally, various results indicate that contractors adopt the Lean approach more frequently than those operating primarily in other phases of a construction project.

In terms of company size, the German construction industry is predominantly composed of small firms with fewer than 50 employees. However, the survey sample largely consisted of larger companies: Only 18% of participating companies had 1–19 employees, 9% had 20–49, 11% had 50–99, 16% had 100–249, and 45% had 250 or more employees. This distribution aligns with observations from Phase 1 and Phase 2, which indicated that Lean Construction is more prevalent among larger companies.

Regarding experience with Lean Construction, 42% of respondents reported working with Lean for at least five years, 27% for 2–5 years, 13% for 1–2 years, and 15% for less than one

year. A small percentage (2%) indicated that they no longer use the Lean approach. To better understand organizational maturity, the survey also asked how many projects the companies currently apply Lean Construction on (see Figure 1).

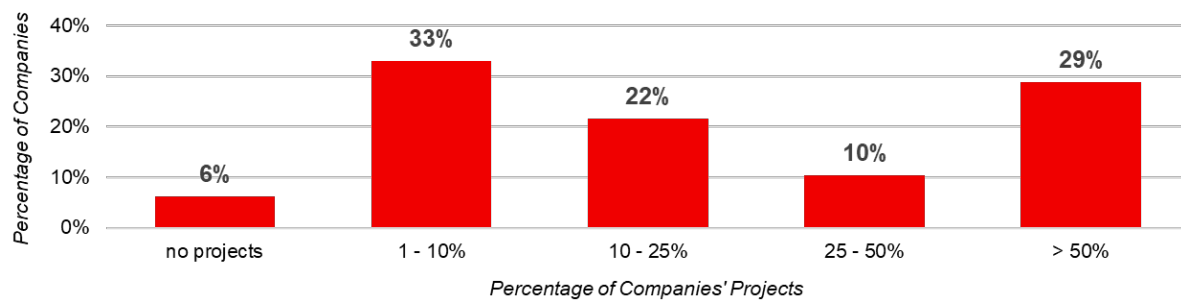


Figure 1: Percentage of Companies by Percentage of Projects with Lean Construction (n=97)

In addition to the interviewed practitioners' observation that Lean is often applied only during specific phases of a project, the survey revealed that even within companies working with Lean Construction, it is not consistently applied across all projects – rather, its application remains limited to a few. Only 29% of respondents reported using Lean in more than 50% of their projects (with just 12% applying it in all their projects). Another 10% reported usage in 25–50% of their projects, while the majority (55%) indicated applying Lean in less than 25% of their projects (33% in 1–10% and 22% in 10–25% of projects). Additionally, 6% of respondents reported not yet actively using Lean but engaging with it conceptually.

An unexpected result regarding the maturity of Lean application in the industry is that only 42% of the companies actively promote the principle of continuous improvement, and just 31% focus on prioritizing the client's needs in their actions. Conversely, 80% indicated that they prioritize transparency in their processes. This suggests that many companies are adopting isolated Lean principles rather than implementing a comprehensive Lean approach.

Regarding the specific ways Lean Construction is applied in projects, Figure 2 illustrates the frequency of application of common Lean methods across the surveyed companies.

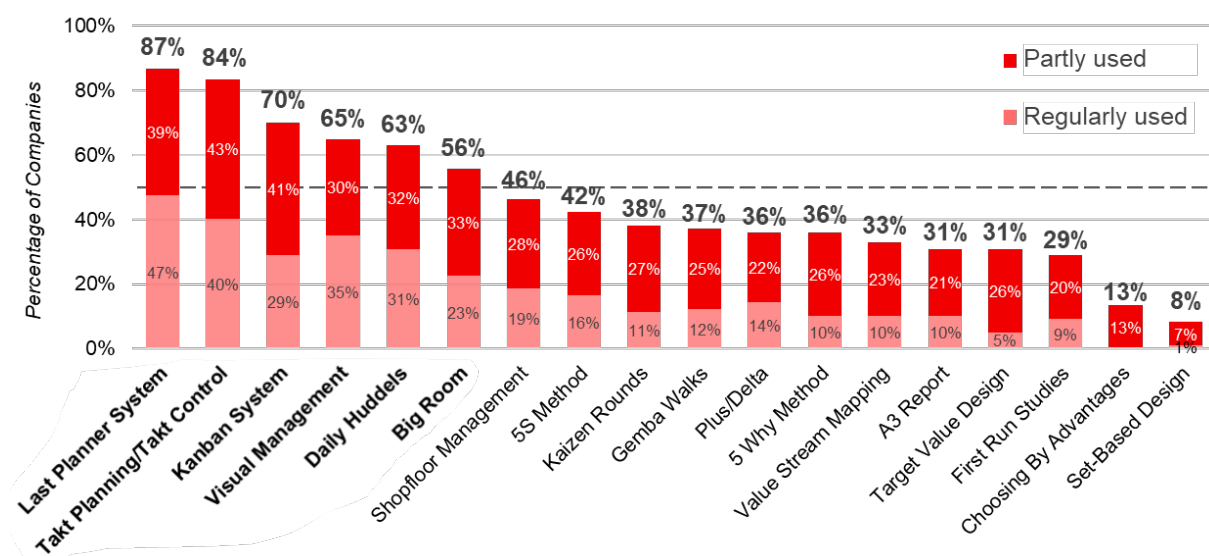


Figure 2: Percentage of Companies Applying Lean Practices/Methods (n=97)

The most widely and regularly applied Lean methods among the surveyed companies are the Last Planner System (LPS) and Takt Planning/Takt Control (TPTC). Both methods are also promoted more frequently in Lean training programs in Germany and are therefore much better

known in the industry than the other methods. LPS has been used by 87% of the respondents, with 47% applying it regularly. Similarly, 84% of the respondents reported using TPTC, with 40% regularly. Notably, these two methods were the only ones recognized by all participants. For other methods, the percentage of participants who are unfamiliar with the terminology of these practices ranged from 5% to 22%. In addition, the following practices have been applied by more than half of the companies: Kanban Systems (70%, 29% regularly), Visual Management (65%, 35% regularly), Daily Huddles (63%, 31% regularly), and Big Rooms (56%, 23% regularly). The least applied were Choosing by Advantages (CBA), used by only 13% of respondents (0% regularly), and Set-Based Design, used by just 8% (1% regularly).

To better understand why many companies still experience relatively low internal extension of Lean, we asked about the reasons why it is not applied in all projects. Notably, 12% did not answer this question, as they already implement Lean in all of their projects (see Figure 3).

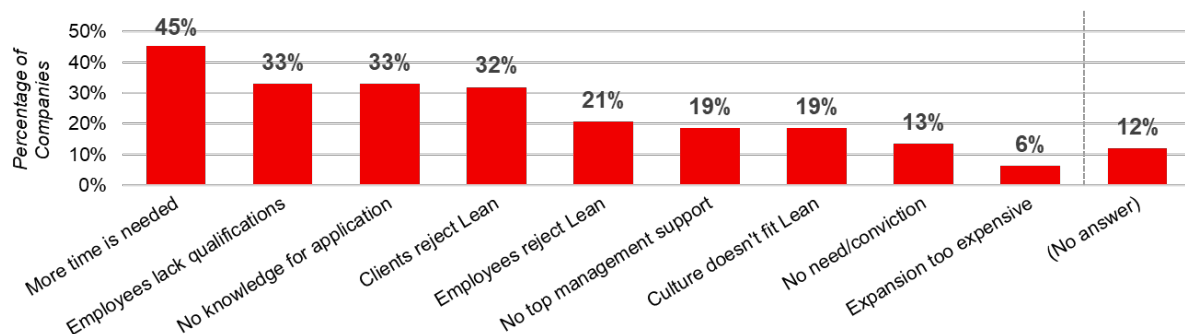


Figure 3: Percentage of Companies Reporting Challenges regarding Extension (n = 97)

45% of the companies indicated that the transformation within their organization requires significant time, which is why Lean has not yet been implemented in all projects – a finding consistent with a study by BYGBALLE and SWÄRD (2014). Approximately one-third of the respondents identified also other challenges, including insufficient employee qualifications (33%), a general lack of knowledge for widespread application (33%), and a lack of demand for Lean from clients (32%). Since construction projects are inherently network activities, successful Lean application requires that all (or the most) stakeholders are both willing and able to engage (see STYHRE et al., 2004). Internal resistance was reported by 21%, with some employees unwilling to engage with Lean. Additionally, 19% of respondents mentioned a lack of top-management support as a barrier to broader implementation – also highlighted by MOSSMANN (2009). Another 19% indicated that their company culture was incompatible. 13% of the companies noted a lack of conviction for applying Lean across all projects, while 6% considered the expansion to all projects too costly. Nonetheless, over half of the companies (55%) have a dedicated Lean department or at least a designated Lean manager responsible for implementing and overseeing the Lean Construction activities of the company. A quarter of the companies (25%) still regularly rely on Lean consultants to support their projects.

CONCLUSION

This study set out to address a gap in Lean Construction research: the lack of a comprehensive, nationwide examination of how Lean is currently practiced in Germany. By systematically identifying 451 “Lean companies” and subsequently gathering data through 15 interviews and a nationwide survey, our findings offer a broader insight into Lean Construction’s actual diffusion and maturity in Germany. The results demonstrate not only the dominance of certain tools (e.g., LPS and TPTC) but also the substantial barriers – particularly limited knowledge and cultural hesitations – that hinder broader implementation. In doing so, we respond to the

need for an empirical overview, thereby contributing practical benchmarks for the industry and helping scholars better tailor future research to the German construction practice.

With regard to the results of phase 1, we believe that the 451 companies cover the vast majority of Lean practitioners in Germany. However, considering an estimated total of over 300,000 construction-related companies, the diffusion of Lean remains below 1%. Building on that, 15 interviews were conducted with practitioners to gain a deeper understanding of Lean Construction in Germany and to gather insights on the industry's overall development in this regard. The discussions highlighted a critical observation: not all Lean practices are truly Lean. The potential of Lean can only be realized when it is used properly. In some cases, it is applied “lightly”, leading to suboptimal results, which may cause Lean adoption to be discontinued. Practitioners identified also substantial potential by improving the execution quality and the degree of implementation, noting that it is still used predominantly in the execution phase.

Using insights from these interviews and findings from the literature, a nationwide survey was conducted in Phase 3, inviting all identified “Lean companies” to participate. A total of 97 responded. The results revealed that only a small proportion of these companies implement Lean comprehensively across their projects at an advanced stage. Most companies apply Lean only in a limited number of their projects. Achieving broader adoption will require more time, additional employee training, and clearer strategies for scaling Lean practices across companies. Furthermore, active demand from clients is often lacking, which remains also a barrier.

These findings confirm that Lean Construction is primarily applied by larger companies, likely due to their greater resources in terms of personnel and financial capacity. While the overall diffusion of Lean in the German construction industry remains low, a number of companies have reached an advanced stage of development. These companies can serve as role models and as evidence that a comprehensive application of Lean brings significant benefits.

In light of this, practitioners can benefit most from systematically allocating time and resources for Lean adoption, ensuring that training and expertise prevent “Lean light” implementations, and fostering strong top-management support to secure the budget and staff needed. An effort to involve clients can further strengthen Lean application. Finally, as many survey participants and interviewees pointed out, Lean succeeds only when accompanied by a supportive organizational culture and transparent processes. By proactively addressing these elements, companies can embed Lean more deeply in their projects and maximize its positive impact. Future research could collect concrete examples of companies that have successfully implemented Lean in this context, potentially offering more tangible guidance for practice.

On a theoretical, overarching level, this study also emphasizes the need for action to improve the diffusion and understanding of Lean Construction. It is essential to demonstrate that Lean is not merely a buzzword but, when applied correctly, delivers significant value for all stakeholders and enhances project outcomes. Lean Construction requires genuine motivation and commitment to be effective. As EBBS et al. (2015) pointed out, Lean is incompatible with “tick-the-box solutions” often required in practice. Lean is not a “ready-to-use” concept (BYGBALLE & SWÄRD, 2014); it requires a strong cultural foundation as fertile ground – a notion emphasized already years ago by HÖÖK and STEHN (2008). Consequently, substantial cultural work is still needed in Germany, not only within Lean-practicing companies but across the whole industry. Addressing these cultural challenges should be a key focus for future research.

While this three-phase study provides valuable insights, several limitations must be acknowledged. First, the survey may be open to response bias, as it largely includes companies that openly declare their Lean activities. Second, the expert-focused interview sample may not fully represent the diversity of Lean practitioners across Germany. Third, despite a rigorous search strategy, some Lean practitioners may remain undetected, limiting the generalizability of the findings. Future research could employ longitudinal designs, broaden sampling frames, and integrate additional data sources to further improve representativeness and validity.

REFERENCES

- Al-Aomar, R. (2012). Analysis of lean construction practices at Abu Dhabi construction industry. *Lean Construction Journal*, 2012, 105-121. <https://doi.org/10.60164/i5e4e8h8d>
- Alves T., Milberg, C. & Walsh, K. D. (2012). Exploring lean construction practice, research, and education. *Engineering Construction & Architectural Management*, 19 (5), 512-525. <https://doi.org/10.1108/09699981211259595>
- Babalola, O., Ibem, E. O. & Ezema, I. C. (2019). Implementation of lean practices in the construction industry: A systematic review. *Building and Environment*, 148, 34-43. <https://doi.org/10.1016/j.buildenv.2018.10.051>
- Backhaus, O. & Dahm, M. (2020). Studie/Analysis of the state of implementation of Lean Construction approaches in selected German construction companies – Results of a qualitative study. *Bauingenieur*, 95 (2), 64-72. <https://doi.org/10.37544/0005-6650-2020-02>
- Braunecker, C. (2023). *How to do empirische Sozialforschung*. Facultas. <https://doi.org/10.36198/9783838561608>
- Brown, T. (2008). Design thinking. *Harvard business review*, 86 (6), 84-141. <https://hbr.org/2008/06/design-thinking>
- Bygballe, L. & Swärd, A. (2014). Implementing Lean Construction: A Practice Perspective. *Proceedings of the 22nd Annual Conference of the International Group for Lean Construction*, 3-14. <https://iglc.net/papers/Details/1022>
- Dillmann, D. A. (1978). *Mail and Telephone Surveys: The Total Design Method*. John Wiley & Sons.
- Dlouhy, J., Binninger, M., Weichner, L. & Haghsheeno, S. (2017). Implementation of Lean Construction in Client Organizations – an Analysis of the Status Quo in Germany. *Annual Conference of the International Group for Lean Construction*, 275-282. <https://doi.org/10.24928/2017/0089>
- Ebbs, P. J., Sexton, P., Greensmith, D. G., Clare, B. G., Gibson, V. & Turner, R. (2015). Lean construction theory and practice: An Irish perspective. *Proceedings of the 23rd Annual Conference of the International Group for Lean Construction*, Perth, Australia, July 28-31, 496-506. www.iglc.net
- Gehbauer, F. (2018). Vorwort. In M. Fiedler (Ed.), *Lean construction - The management handbook: Agile methods and lean management in construction* (pp. XVII–XX). Springer.
- Haghsheeno, S. & John, P. C. (2024). Marktbericht – Bauherrnseitige Projektmanagement-Dienstleistungen in Deutschland. *DVP Deutscher Verband für Projektmanagement in der Bau- und Immobilienwirtschaft e. V.* <https://doi.org/10.5445/IR/1000170493>
- Höök, M. & Stehn, L. (2008). Lean principles in industrialized housing production: The need for a cultural change. *Lean Construction Journal*, 2008, 20-33. <https://doi.org/10.60164/03a3c4g7c>
- Johansen, E. & Walter, L. (2007). Lean construction: Prospects for the German construction industry. *Lean Construction Journal*, 3 (1), 19-32.
- John, P. C., Maier, E. & Weinmann, M. (2025). Lean Management und Agiles Management – Eine Analyse von Gemeinsamkeiten und Unterschieden. *Tagungsband zum 34. BBB-Assistent*innen-Tagung* (Berlin).
- John, P. C., Niederprüm, K., Maier, E. & Haghsheeno, S. (2024). Lean construction in Germany: Study on the status quo of the application of lean construction in Germany [Poster]. *10th GLCI Congress*. <https://doi.org/10.5445/IR/1000176339>
- Kraus, P. & Weitz, H. (Hauptverband der Deutschen Bauindustrie e. V.) (2024). *Bauwirtschaft im Zahlenbild*. www.bauindustrie.de/media/veroeffentlichungen/artikel/bauwirtschaft-im-zahlenbild-2024

- Malvik, T. O., Torp, O. & Johansen, A. (2024). Awareness, Understanding, and Use of Lean Construction in the Norwegian Construction Industry. *Lean Construction Journal*, 2024, 29-58. <https://doi.org/10.60164/4g5pkxm74>
- Mossmann, A. (2009). Why isn't the UK construction industry going lean with gusto?. *Lean Construction Journal*, 2009, 24-36. <https://doi.org/10.60164/i2h6a6c6f>
- Pan, W. & Pan, M. (2016). Status quo and future development of lean construction in Hong Kong. *CIB World Building Congress 2016 Intelligent Built Environment or Life*, Tampere, Finland. https://www.irbnet.de/daten/iconda/CIB_DC29338.pdf
- Sarhan, J. G., Xia, B., Fawzia, S. & Karim, A. (2017). Lean Construction Implementation in the Saudi Arabian Construction Industry. *Construction Economics and Building*, 17 (1), 46-69. <https://doi.org/10.5130/AJCEB.v17i1.5098>
- Schnell, R., Hill, P. B. & Esser, E. (2018). *Methoden der empirischen Sozialforschung*. De Gruyter Oldenbourg.
- Singh, A., Kumar, V., Mittal, A. & Verma, P. (2023). Identifying critical challenges to Lean Construction adoption. *Construction Innovation*, 24 (1), 67-105. <https://doi.org/10.1108/CI-09-2022-0229>
- Styhre, A., Josephson, P. & Knauseder, I. (2004). Learning capabilities in organizational networks: Case studies of six construction projects. *Construction Management and Economics*, 22 (9), 957-966. <https://doi.org/10.1080/0144619042000241417>
- Weinmann, M., Bär, T., John, P. C. & Haghsheno, S. (2025). A Decade of Transformation: The Role of the German Lean Construction Institute in the Construction Industry. *Proceedings of the 33rd Annual Conference of the International Group for Lean Construction*. <http://doi.org/10.24928/2025/0131>