UNLOCKING LEAN CONSTRUCTION: DECODING THE ROOT CAUSES OF INITIAL IMPLEMENTATION FAILURES

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ABSTRACT

Lean construction has emerged as a promising approach to enhance efficiency, reduce waste, and improve project performance in the construction industry. Despite the promising potential, many projects struggle with the initial implementation of lean principles, leading to failures such as disrespect for people and resources, cost overruns, schedule delays, stakeholder misalignment, and compromised quality. This research investigates the reasons behind these initial failures and explores how they shape the broader industry's perception of lean construction.

Drawing from a comprehensive case study of a higher education dormitory and dining facility project, the study explores failure points during the researcher's first attempt to implement lean principles. These insights are triangulated with interviews of four seasoned lean professionals, each with extensive experience at top construction firms, and an industry-wide survey. The interviews emphasize the importance of a human-centric approach, the challenges posed by resistance to change, diverse perceptions of failure, the necessity of measuring success, and innovative strategies for initial lean implementation. The survey results reinforce these themes, highlighting common barriers such as poor understanding of lean principles, lack of resources and support, and misalignment among project stakeholders.

The research categorizes these challenges into Human-Centric (HC), Process (P), and Resource (R) factors, drawing on established socio-technical theories. Human-Centric factors focus on leadership dynamics, team engagement, and cultural shifts, while Process factors relate to workflow management and continuous improvement, and

Resource factors address the effective allocation of materials, tools, and financial support. The findings suggest that achieving success in lean construction requires a holistic approach that not only addresses the technical aspects but also emphasizes the importance of trust, empathy, and alignment among all project participants. By focusing on the human element, lean construction can foster a culture of respect and empowerment, ensuring that projects meet both technical and human-centered goals.

This research serves as a call for a systemic, socio-technical perspective to address lean construction implementation failures, recognizing the reinforcing loops that make isolating root causes difficult. The study identifies several key areas for future research, including strategies to overcome human-centric barriers, the role of empathy in leadership, and the impact of personal dynamics in the industry. By addressing these factors, the construction industry can enhance the successful implementation of lean principles, ensuring sustainable improvements and value creation that benefit both projects and the people involved.

DEDICATION

This thesis is dedicated to the hardworking people in the construction industry who tirelessly build the infrastructure that our world depends on, despite the poor systems that they must operate within. Your dedication, skill, and perseverance inspire this research. May society recognize the true value that you bring every day.

To my mentors and colleagues, whose wisdom, guidance, and feedback have been invaluable. Your contributions have profoundly impacted my understanding and approach to utilizing lean principles in construction.

Finally, to all those who are committed to improving the construction industry through the application of lean principles. May this work contribute to the ongoing quest for respect, efficiency, and excellence in our field.

ACKNOWLEDGMENTS

Completing this thesis has been a significant journey, and it would not have been possible without the support and contributions of many individuals and organizations. I want to specifically acknowledge Dr. Bob Emiliani for taking several phone calls and meetings with me to better understand the results that I received. The addition of Dr. Emiliani's previously studied work on lean failures added a great depth of knowledge to my understanding of the root causes of lean failures. I would also like to acknowledge Dr. Colin Milberg for his numerous intermediate reviews, hours of brainstorming, and input on the results and findings. Your ability to switch between practitioner and academician is quite amazing to me! I'd also like to acknowledge the project team that allowed me to experiment as the Lean Champion, the 4 Seasoned Lean Professionals that allowed me to interview them for exclusive content, and the 116 survey participants that took the time to fill out the survey!

To my Advisor, Dr. Clarke – I know I'm one of the most frustrating students you have ever had as I bounce from Practitioner to Academic. Thank you for hanging in there with me and never giving up on me! In addition, I want to acknowledge the remainder of my thesis committee: Dr. Jason Lucas, Dr. Vivek Sharma, and Dr. Colin Milberg. Your guidance, support, and dedication throughout this process have been invaluable. The countless hours spent reviewing drafts, providing feedback, and offering encouragement have profoundly shaped this work. I deeply appreciate and admire your expertise and unwavering commitment to my personal development as a researcher.

You all inspire me, and I will be forever grateful!

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CHAPTER I

INTRODUCTION

In recent years, the construction industry has increasingly turned to lean construction as a promising methodology for enhancing project efficiency and effectiveness (Aslam, 2024). Rooted in principles initially developed in the manufacturing sector, lean construction seeks to streamline processes, eliminate waste, and deliver projects that meet or exceed stakeholder expectations—all while maintaining a profound respect for the people involved in the work. Despite the considerable potential of lean construction, transitioning from traditional construction management practices has presented notable challenges (Alves, 2012). Many projects have struggled with adopting lean principles, resulting in cost overruns, schedule delays, misalignment among stakeholders, giving up on lean principles, and compromised quality (Albalkhy, 2020). Based on the researcher's extensive field experience, these recurring issues have contributed to eroding confidence in lean approaches within the construction industry.

This research investigates why lean construction initiatives often fail to deliver anticipated benefits during their initial implementation, especially in construction projects attempting to integrate these principles for the first time. By combining personal observations from a higher education case study, interviews with experienced lean leaders from Engineering News Record (ENR) Top 400 Contractors, and a comprehensive survey of industry professionals, the researcher provides a nuanced understanding of the barriers to successful lean implementation. The intention is to explore not only the operational and tactical missteps but also to gauge the broader

industry's sentiment towards lean construction, reflecting on how these perceptions shape the attempts, adoption, and sustained use of lean principles on construction projects.

The term 'failure' in the context of this research is defined as the inability of a construction project team to fully integrate and leverage attempted lean principles, resulting in a shortfall from expected project performance metrics. Such failures manifest in various forms, including inefficiencies in project timelines, budget overruns, lack of engagement among construction workers, abandonment of lean tools, and a reversion to traditional practices before the potential benefits of lean construction can be realized. In the researcher’s experience, these issues not only affect immediate project outcomes but can also have lasting impacts on stakeholder satisfaction, the overall success of construction projects, and the reputation of construction firms. Notably, the concept of 'failure' itself can differ based on individual histories, cultural backgrounds, and disciplinary perspectives (Appadurai, 2016).

Despite growing interest and investment in lean construction methodologies, there remains a significant gap in understanding the precise reasons behind the frequent failures of initial lean implementations. This study aims to address this gap by providing an in-depth examination of the challenges faced during the initial stages of lean adoption. By uncovering these root causes and analyzing their impact on the construction industry's perception of lean construction, this research contributes valuable insights that could inform more effective implementation strategies, foster a culture of continuous improvement, and ultimately enhance the success rate of lean construction initiatives.

Research Objective:

To analyze the multifaceted causes underlying the initial failures in lean construction implementation and assess how these failures influence the construction industry's overall perception and acceptance of lean principles.

Research Question #1:

What are the factors contributing to failures in the initial implementation of lean principles on construction projects?

This question aims to dissect the various human-centric (HC), process (P), and resource (R) challenges that construction projects encounter when integrating lean principles for the first time.

Research Question #2:

How do initial implementation failures with lean principles on construction projects shape the broader industry's perception of lean construction?

This question seeks to understand the ripple effects of implementation failures on the construction industry's collective mindset towards lean construction, exploring whether such failures deter future adoption or investment in lean practices.

By addressing these questions, this research highlights the challenges and barriers that impede the successful adoption of lean construction. It provides a foundation for future research to develop more effective strategies and best practices, equipping

construction teams with the knowledge and tools necessary to navigate the complexities of initial lean implementation and enhance the likelihood of success in future initiatives.

CHAPTER II

LITERATURE REVIEW

Lean construction is a management approach that has been widely adopted throughout the construction industry to improve efficiency, reduce waste, and enhance project performance. Despite the numerous benefits of lean construction, many construction projects fail to implement successfully. This literature review aims to explore the reasons why the initial implementation of lean principles on construction projects fails, and what the current industry's perception of lean construction is.

The term lean as applied to lean manufacturing, the foundation of lean construction, was first coined by John Krafcik while working on his graduate work at MIT's International Motor Vehicle Program in 1988. His paper, "Triumph of the Lean Production System," challenged the status quo on what factors determine the success of car manufacturing performance. (Krafcik, 1988) This led to additional research which studied Japanese automakers, including the Toyota Production System and observed some key differences to the traditional United States' mass production systems. A few of the lean principles the researchers identified were continuous improvement, elimination of waste, and an intentional focus on customer value. (Womack, J et. al, 1990) Koskela was the first person to relate these manufacturing principles, such as Just in Time delivery, and Total Quality Control to the construction industry (Koskela, 2000). Lauri Koskela challenged the construction industry to adopt these strategies, concepts, and tools as 'a new production philosophy' (Koskela, 2000). During the inaugural

International Group for Lean Construction conference in Espoo, Finland led by Koskela in 1993, a small group of researchers decided to take on the name ‘lean construction’.

Most of the research compiled to date regarding lean construction is focused on improving production within the industry. The Last Planner System (LPS), created by Glenn Ballard, has been the subject of several research papers that describe lean construction (Ballard, 2000). LPS has been recognized as a significant improvement in production reliability over traditional methods of project planning approaches in the construction industry. By including the people who are responsible for completing the work in the planning of the work, the workflow becomes more reliable (Vaziri, Arian 2018).

In addition, there has been significant research on the barriers of applying lean construction. As studied by Moradi, S., et. al, in 2023, the following barriers were identified and prioritized based on numbers of mentions in prior research: The lack of awareness and understanding of Lean Construction (LC) was mentioned 12 times in several countries. The next barrier, mentioned 8 times, was resistance to change (management and employees), followed by mentions of 6 each were lack of support and commitment from top management and lack of required competencies both at managerial and employee levels. In addition, mentioned 5 times each, were a lack of lean consultants, education, and training, insufficient funding, and a lack of effective communication among project participants. Followed by 4 mentions of insufficient support from the government, and finally 3 mentions each with regards to lack of performance measurement systems, poor understanding of customer needs and poor

customer focus, and finally a lack of involvement and transparency among stakeholders (Moradi, S. et. al, 2023).

Although barriers to implementing lean construction have been well studied and published, Lean Construction failures have not been. In the context of this research, a barrier refers to an obstacle or factor that impedes the initial implementation or smooth integration of lean construction principles. Barriers are typically challenges or conditions that, if unaddressed, make the adoption process more difficult but do not inherently result in project failure on their own. Examples include lack of leadership commitment, resistance to change, or insufficient training—all of which can hinder the application of lean principles but may not directly lead to failure if managed effectively. Important to note that many of these same barriers align well with the barriers for Lean Construction.

A failure, on the other hand, is the result of these barriers remaining unaddressed or inadequately managed, leading to the inability of the project team to fully integrate and leverage lean principles as intended. Failure in this research is defined as a shortfall from expected project performance metrics due to the project team's inability to overcome barriers, resulting in consequences like inefficiencies, cost overruns, disengagement, and reversion to traditional methods. While barriers set the stage for potential difficulties, failure is the actualized outcome when these barriers prevent the successful achievement of lean objectives.

The lack of transparency of construction failures is found evident in the research completed by Kenny when studying failures on Indiana Government Road Projects. (Kenny, C. 2010). Leaders learn from their own failures through the behaviors of

reflection, understanding their internal locus of control, and using failure to continually learn (Mulqueen, C. 2005). The McKinsey Consulting Group reports that 70% of all change management efforts fail (Jones-Schenk, J. 2019). In Bob Emiliani's book, Irrational Institution, he states that without scientific proof the failure rate of lean implementation among all businesses is between 95%-97.5%. (Emiliani, 2020) Other research on organizational change failures has identified several factors that contributed to unsuccessful change programs. These included lack of education and training, inadequate management support, inappropriate organizational culture, inadequate resources, poor communication, inappropriate planning, and a lack of monitoring and measuring the system. (Mosadeghrad, A. M. ,2014).

Despite the widespread recognition of lean construction's potential benefits, its successful application remains inconsistent across the industry. This inconsistency begs a deeper investigation into the underlying causes of lean implementation failures, moving beyond the identification of barriers to examining the human-centric (HC), process (P), and resource (R) factors that contribute to these shortcomings.

Due to the lack of research dedicated to construction, the literature review was expanded to incorporate a general industry view on why organizations fail to achieve the intended outcomes from lean transformations. Dr. Bob Emiliani has published six books dedicated to understanding lean transformation failures from six different angles. As stated by Dr. Emiliani, "To my knowledge, I am the only one who has looked at the problem from different directions: status and privilege, irrationality, secular spirituality, aesthetics, preconceptions, and workmanship." (LinkedIn Message and Conversation,

Jan. 27, 2024) Dr. Emiliani argues throughout his writing that there are extreme parallels between scientific management from the late 1800's, to progressive management through the 1900's and now into Lean management; this unique management technique of true servant leadership to the people who are laboring for the company has tried to take root with a few different disguises. (Emiliani, B., 2018)

Dr. Emiliani's pivotal works like "The Triumph of Classical Management Over Lean Management" and "Irrational Institutions," delves deep into the sometimes-hidden systemic barriers that hinder the implementation of lean principles within organizations (Emiliani, B., 2018, 2023). A significant portion of his research is dedicated to unraveling the complexities surrounding leaders' status, rights, and privileges. Emiliani articulates how these entrenched hierarchical positions often become a formidable obstacle to the egalitarian and collaborative ethos that lean management espouses. (Emiliani, B. 2018) Leaders, accustomed to their established roles and the deference they command, may exhibit reluctance or outright resistance to adopting lean principles that advocate for a more decentralized and participative approach (Emiliani, B., 2018).

Furthermore, Emiliani's discourse extends to the realm of irrational decision-making, where decisions are frequently influenced by self-interest rather than the collective good or empirical evidence. This biased view can lead to a rejection or superficial adoption of lean methodologies, undermining their potential to transform organizational processes and culture (Emiliani, B., 2020).

Emiliani also touches upon the concept of secular spirituality, encapsulating the notion of 'this is how things have always been done.' This resistance to change, rooted in

a deep-seated adherence to traditional practices, poses a significant challenge to implementing lean principles, which necessitate a departure from conventional wisdom and a willingness to embrace new, more efficient methods (Emiliani, B., 2020). The aesthetic dimension of leadership, as discussed by Emiliani, highlights the importance of the visual and experiential aspects of lean management. Leaders are encouraged to appreciate and foster an environment where the lean principles are not only implemented but are also visibly and tangibly manifested in the workplace, enhancing both functionality and form (Emiliani, B., 2020, 2022).

Preconceptions and people's previous experiences with lean, often based on incomplete understanding or past experiences, further complicate its adoption. Emiliani advocates for a clear and comprehensive education on lean principles, dispelling myths and fostering a deeper appreciation for lean philosophy (Emiliani, B., 2023).

Lastly, the workmanship of leaders underscores the craftsmanship that effective leadership entails in the context of lean implementation (Emiliani, B., 2023). Leaders must hone their skills, much like artisans or skilled trade workers, to guide their teams through the transformative journey of lean, ensuring that every decision, action, and strategy is crafted with precision, care, and a commitment to excellence (Emiliani, B., 2023).

The remainder of research that exists seems to lack a true path forward. Jim Womack's reflections on "Where Lean Has Failed" underscore the necessity for a reinvigorated commitment to lean, despite historical challenges, advocating for a strategic and iterative approach to its implementation (Womack, J., 2017). Womack emphasizes

that realizing the full potential of lean requires more than just mechanical tool adoption; it demands a cultural shift towards continuous improvement and value creation. Chris Ortiz, in his book, "How Lean Manufacturing Failed – Gung Ho", provides a practical illustration of an organization's leap into lean, marked by enthusiasm but leading to suboptimal outcomes due to a lack of foundational understanding of first lean principles and preparation (Oritz, C., 2008). John Seddon and Brendan O'Donovan in "An Exploration into the Failure of 'Lean'" critique the superficial application of lean, arguing for a deeper engagement with the core philosophies that underpin lean thinking to avoid implementation failures in service organizations (Seddon, J., & O'Donovan, B., 2015). Note the latter research is advocating for doing more of the same things that have not been working throughout the previous 100 years (Seddon, J., & O'Donovan, B., 2015).

In combining the insights gathered from the exploration of lean construction's initial implementation challenges, this literature review underscores the intricate balance between theory and practice in the realm of lean construction. The journey from the foundational principles laid down by pioneers like Womack, Jones, and Koskela to the practical application of these principles in the construction industry encapsulates a spectrum of successes and setbacks. The significant contributions of Bob Emiliani, particularly his examination of the nuanced barriers to lean implementation such as leadership dynamics, irrational decision-making, and the resistance rooted in 'secular spirituality,' provide a critical lens through which to view these challenges. Emiliani's work, especially his focus on the aesthetic and workmanship of leaders, offers a profound

understanding of the leadership perspective in the context of lean transformation (Emiliani, B., 2018, 2023).

The broader discourse, enriched by additional perspectives from researchers like Womack, Ortiz, Seddon, and O'Donovan, presents a multifaceted view of the hurdles faced with the initial implementation of lean principles on construction projects. Yet, it is Emiliani's comprehensive analysis that stands out, offering the deepest dive into the systemic, cultural, and personal factors that often hinder the successful adoption of lean principles. This literature review, while acknowledging the diverse range of insights on lean failures, illustrates that a completely new and different approach to lean education and implementation is necessary. One that not only equips practitioners with a toolbox of lean methodologies but also instills a problem-solving ethos, ensuring that lean principles are applied in a manner that benefit the people who boar to get work done, providing ultimate true value add. The path forward requires a blend of academic and practical wisdom, leveraging the rich body of knowledge on lean failures to forge intentional strategies that are detailed, adaptable, and culturally congruent with the current ways of the construction industry.

Categorization of Themes

An analysis of the literature reveals that the factors contributing to the success or failure of lean construction fall into three overarching categories: Human-Centric (HC), Process (P), and Resource (R). The Human-Centric (HC) category emphasizes the behavioral, cultural, and leadership dynamics essential for successful lean construction.

Themes that fall under HC include Trust and Leadership Commitment, Resistance to Change, and Insufficient Team Buy-In. These themes align with many of the failures identified in the research, including a lack of trust, resistance to change, and insufficient engagement from project teams. For example, Emiliani (2020, 2018) emphasizes the critical role of leadership commitment and behavioral dynamics in building trust, which is fundamental to successful lean construction. Similarly, the work of Womack & Jones (1996) emphasizes the importance of engagement and support from team members.

The Process (P) category includes themes related to methods, workflows, practices, and protocols that drive efficient management and continuous improvement. Specific examples of process factors include Last Planner System (LPS), Visual Management Tools, and Flow of Work and Continuous Improvement. These factors aim to enhance the flow of work, ensure transparent communication, and promote reliable planning practices. Koskela (2000) and Ballard (2000) have extensively discussed the importance of implementing proper methodologies, such as LPS and visual management tools, which are key to optimizing workflow and improving project reliability. By emphasizing these factors, the Process category ensures that lean practices are carried out efficiently, as intended by foundational lean principles.

The Resource (R) category focuses on the strategic allocation of physical, financial, and informational assets necessary to support lean construction. Examples of resource-related themes include Material Flow and Financial Planning, Logistical Support, and Efficient Use of Tools and Assets. Ortiz (2008) and Seddon & O'Donovan (2015) highlight the importance of efficient material flow, logistical coordination, and

resource management in ensuring that lean construction environments can be sustained over time. These resources are critical in maintaining the infrastructure that supports lean practices and ensures smooth implementation.

By categorizing these elements into Human-Centric, Process, and Resource, it becomes easier to understand the different facets of lean construction and how each impacts the initial implementation process. The Human-Centric focus on leadership, commitment, and cultural alignment is crucial for overcoming the cultural and behavioral barriers highlighted by Emiliani and others. Process optimization aligns with the core principles of lean that Koskela, Ballard, and Womack have extensively discussed, emphasizing the importance of proper methodologies for planning and workflow management. The Resource aspect, as noted in the work of Ortiz and Seddon, addresses the need for efficient use of materials, financial planning, and logistical support, which are integral to sustaining lean practices.

This structured categorization supports the overarching goal of lean construction—to create a streamlined, efficient, and value-driven process. Recognizing the importance of balancing Human-Centric, Process, and Resources allows researchers and practitioners to better assess the multifaceted challenges and opportunities within lean implementation, paving the way for a more intentional and informed application of lean construction principles across the industry.

In summary, categorizing themes into Human-Centric, Process, and Resource elements provides a structured approach to understanding the barriers to and enablers of lean implementation in construction projects. This categorization aligns with existing

research on socio-technical systems, lean workflows, and resource management, providing a comprehensive framework that considers all facets of lean adoption (Mumford, 2006; Koskela, 2000; Womack & Jones, 1996). It allows for a holistic understanding of how lean principles can be successfully applied, highlighting the need for effective leadership, sound processes, and efficient resource allocation.

Category	Theme	Description	Paper/Author Related
Human-Centric (HC)	Trust and Leadership Commitment	Emphasizes the importance of behavioral and cultural dynamics, such as building trust and obtaining leadership commitment, for successful lean implementation.	Emiliani (2020, 2018); Mumford (2006)
	Resistance to Change	Focuses on overcoming cultural resistance to adopting new methods and processes within construction projects.	Akugizibwe & Clegg (2014); Emiliani (2020)
	Insufficient Team Buy-In	Addresses the lack of engagement or willingness from team members to support lean principles.	Womack & Jones (1996); Emiliani (2022)
Process (P)	Last Planner System (LPS)	Highlights methodologies and workflows that contribute to better planning and reliability in lean construction projects.	Ballard (2000); Koskela (2000)
	Visual Management Tools	Refers to the tools and practices used to make workflows more transparent, allowing for easier monitoring and adjustment.	Koskela (2000); Womack & Jones (1996)
	Flow of Work and Continuous Improvement	Focuses on creating efficient processes that enable continuous improvement, aligning with core lean principles.	Koskela (1992); Womack, Jones, & Roos (1990)
Resource (R)	Material Flow and Financial Planning	Addresses the allocation of physical resources (materials) and the financial planning needed to support lean construction.	Ortiz (2008); Seddon & O'Donovan (2015)
	Logistical Support	Refers to the logistics and coordination of resources necessary to maintain lean practices on-site.	Seddon & O'Donovan (2015); Ortiz (2008)
	Efficient Use of Tools and Assets	Focuses on maximizing the utility of tools, funding, and informational assets for a lean environment.	Womack & Jones (1996); Seddon & O'Donovan (2015)

Table 1 Categorization of Literature review

CHAPTER III

RESEARCH METHODOLOGY

This research critically examines the complexities associated with the initial failures in lean construction implementation, utilizing a triangulated methodological approach to ensure both depth and rigor in the findings. (Creswell, 2018) Drawing on over two decades of the Researcher's practical experience within the construction industry, the methodology is designed to capture the challenges of lean construction through a combination of qualitative and quantitative methods. Data collection for this study occurred between November 2023 and January 2024, followed by an in-depth analysis spanning the subsequent eight months to comprehensively interpret and understand the insights gained. The following outlines the methodological framework employed in the development of this research.

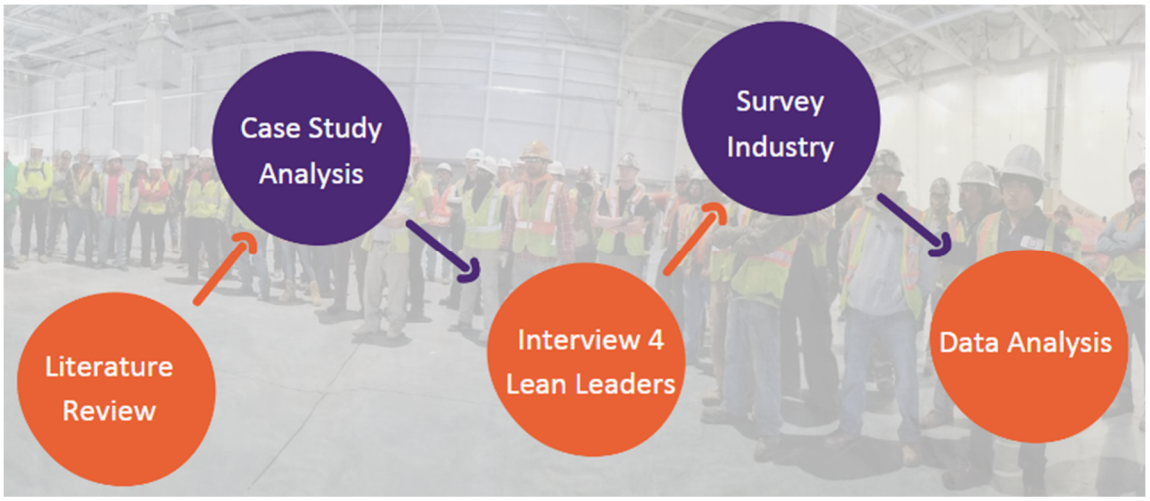

Figure 1 Methodology Flow

Methodology Flow

The research methodology commenced with an in-depth analysis of an initial case study, focusing on the implementation of lean principles within a Higher Education Dormitory and Dining Facility construction project. This phase formed the cornerstone of the study, allowing for an exploration of real-world challenges and intricacies in lean construction practices. The reflections from this case study not only illuminated the obstacles encountered during the implementation but also informed the subsequent stages of research. As shown in the methodological flow chart, these learnings helped shape a tailored interview guide to delve deeper into the issues that surfaced during the case study, aiming for a holistic understanding of the failure points in lean implementation.

Next, the research transitioned to conducting semi-structured interviews with four experienced lean leaders, who were selected based on their extensive contributions and involvement in lean construction. These interviews were guided by findings from the case study and literature review, ensuring that the questions were pertinent and targeted. Each interview, lasting between 1 to 1.5 hours, provided rich qualitative data that added depth to the understanding of lean challenges, particularly focusing on leadership, buy-in, and trust-building—core issues often identified as barriers to successful implementation.

To gain a wider perspective and validate the qualitative findings, an industry-wide survey was designed and distributed to over 116 construction professionals, targeting different roles within the industry. The survey was deployed through multiple channels, including the Associated General Contractors (AGC) CM Lean graduates newsletter, the Lean Construction Institute's monthly update, and LinkedIn posts to reach a broader

audience. The survey contained a combination of Likert scale questions and open-ended responses, as per Dillman et al. (2014), to measure both the prevalence and perception of lean challenges. The feedback gathered provided a quantitative validation of the themes highlighted in both the case study and the interviews.

A crucial aspect of this study's methodology was triangulation, which enhances the reliability and robustness of the findings by incorporating multiple perspectives through case studies, interviews, and an industry-wide survey. Only themes consistently emerging across these data sources were considered for the final analysis, strengthening the credibility of the research. As Creswell and Creswell (2018) assert, triangulation allows researchers to cross-verify data, identifying patterns and themes across datasets to mitigate individual biases. This approach aligns with Leech and Onwuegbuzie's (2007) recommendations on using diverse qualitative data analysis tools to gain a holistic view of the factors influencing lean construction implementation.

The study also incorporated content analysis principles outlined by Krippendorff (2018), applying a frequency-based analysis to identify recurring themes. By comparing themes across each research stage and resolving discrepancies, as illustrated in the flowchart below, the study ensured that findings were grounded in multiple sources and not isolated to a single dataset. Together, these triangulated methods allowed the study to rigorously address its research questions, providing insights into the systemic and multifaceted nature of the challenges associated with implementing lean practices.

This structured methodological flow that moves from case study, to interviews, to an industry survey, facilitated an iterative and cumulative research approach, where each

phase contributed to a deeper understanding of the failure and success leverage points for initial lean implementation. The integration of both qualitative and quantitative data provided a multidimensional perspective, offering a more nuanced view of lean construction practices, their initial implementation challenges, and the construction industry's broader perception of lean methodologies. This approach allowed the research to synthesize actionable insights to inform future lean implementations and strategies for overcoming the barriers highlighted in the findings.

Data Collection Framework Methodology

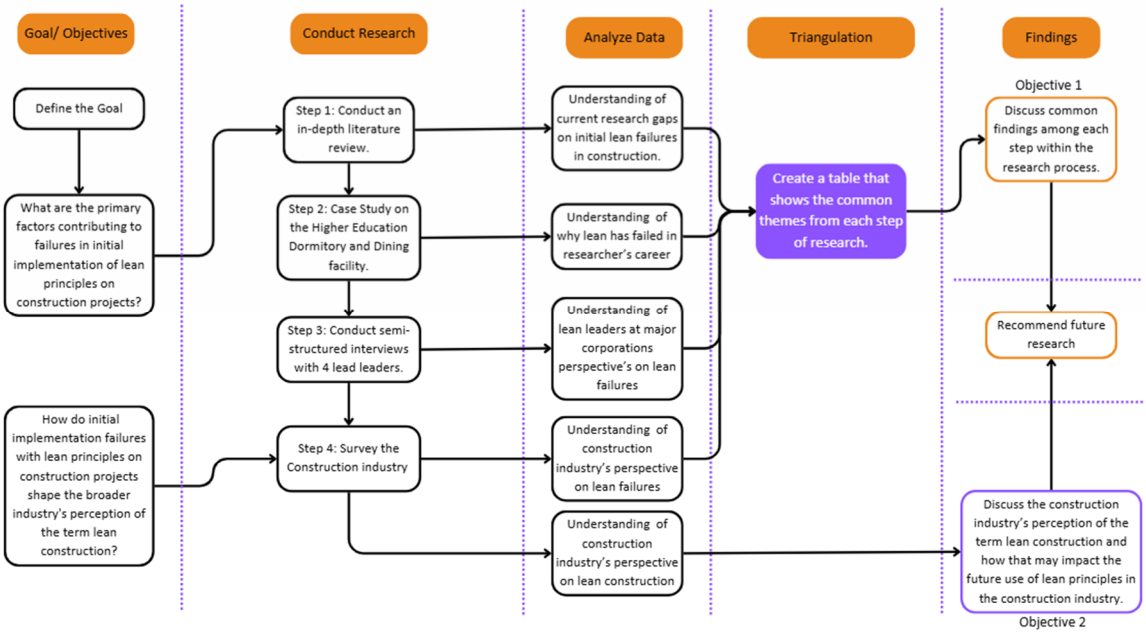

Figure 2 Data Collection Methodology Flow Chart

Literature Review Methodology

The literature review methodology used in this research followed a structured and iterative process aimed at identifying existing knowledge gaps with the failures with the

initial implementation of lean principles on construction projects. The process was grounded in comprehensive keyword searches, exploratory analysis, and a systematic approach to expanding the scope of inquiry. The accompanying flowchart illustrates the development of the literature review and the iterative approach taken in refining the focus areas and identifying key sources.

The literature review journey began with the recognition of the research problem: what are the reasons for the failure of initial implementation of lean principles in construction projects. The researcher's 22 years of experience across various roles in the construction industry led to the realization of a significant gap in the effective adoption of lean practices. This realization informed the need for a thorough investigation of both the industry-specific and cross-industry challenges related to lean implementation.

In the first stage, the researcher focused on identifying existing literature that examined gaps in the initial implementation of lean principles. Keywords such as "Lean Construction," "Lean Construction Failures," "Construction Failures," "Lean Construction Barriers," and "Lean Construction Fail" were employed to conduct comprehensive searches that resulted in over 150 relevant articles. These articles introduced significant authors such as Laurie Koskela, Glenn Ballard, James Womack, and Sina Moradi, whose work formed the initial foundation of this review.

From the literature review, two major themes emerged: lean construction has predominantly been studied as a production tool, and significant barriers to lean implementation have been documented. However, the gap concerning the root causes of failure in the initial implementation of lean principles on construction projects became

evident. The researcher then took these findings into the thesis proposal phase, presenting the results to the thesis committee. Following this presentation, the need to expand the scope of the literature review beyond the construction industry was identified.

In the expanded literature review phase, additional keywords were employed, including "Lean Failures," "Lean Manufacturing Failures," and "Define Lean Failure." These searches broadened the literature review to include books, blogs, and articles related to lean manufacturing and general industry practices. During this phase, the researcher discovered the works of Dr. Bob Emiliani. Through direct contact on LinkedIn, the researcher established a connection with Dr. Emiliani, who recommended five of his books, each of which was incorporated into the expanded literature review. These books, including "The Triumph of Classical Management Over Lean Management," "Irrational Institutions," "Management Mysterium," "The Aesthetic Compass," and "A Changed Perspective," provided critical insights into the failures and challenges associated with lean transformations.

The final literature review chapter was a culmination of this iterative process, bringing together insights from construction and broader industry perspectives. This iterative, evolving process of literature analysis helped identify key factors contributing to the initial failure of lean implementation, focusing on the interplay between human-centric, process, and resource factors, forming the basis for further research and investigation.

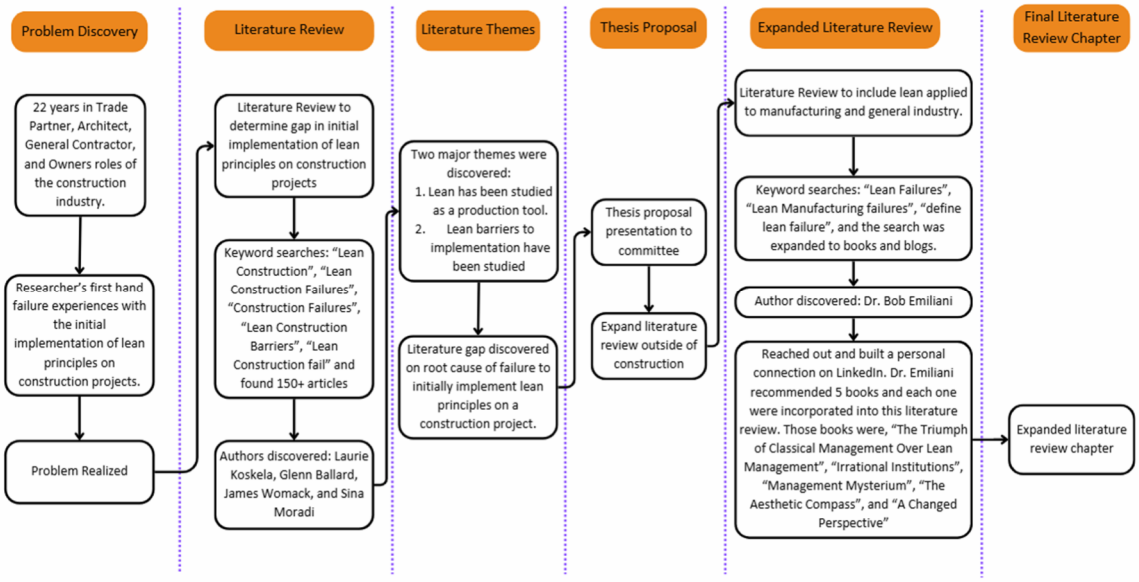

Figure 3 Literature Review Methodology Flow Chart

Case Study Methodology

At the heart of this investigation lies a detailed case study of the researcher's personal journey with lean construction on a higher education dining and dormitory facility project. This case study serves as a reflective examination of the firsthand pitfalls encountered and lessons learned during the initial implementation of lean principles on a construction project. The case study narrative will provide a contextual backdrop against which the broader research findings can be used to further validate points uncovered within the expert interviews and industry survey.

The case study methodology for this research was designed to explore the initial failures of lean implementation in a construction context. The approach began with establishing a solid foundation through the researcher's personal experience in various construction roles over the past 22 years, coupled with insights from literature. The case study preparation included detailed discussions with five project team members from

different roles: three from the same company, one representing the owner, and one designer. This provided a diverse perspective on the project dynamics and lean challenges. Additionally, the researcher reviewed historical project photos and documents to better understand the background and context.

A reflective process followed, in which the researcher connected their past experiences with lean principles, documenting information about the project. The researcher then detailed their observations regarding why lean failed on the project and what could have been done differently. In the analysis phase, common themes were identified across the gathered data, and triangulation was used to cross-validate these themes with insights from other research methods (such as interviews and surveys). The findings from this analysis were synthesized into a dedicated "case study chapter," offering an in-depth narrative of the case study's role in understanding lean implementation failures. The outcome of the case study analysis will be a fishbone diagram that systematically identifies and categorizes the root causes of the failure to implement lean principles on the project. This method, as outlined by Coccia (2018) provides a structured approach to analyzing complex interdependencies and failure dynamics. The flowchart in figure 4 below visually represents the structured and iterative process of data collection, reflection, analysis, and synthesis used in the case study.

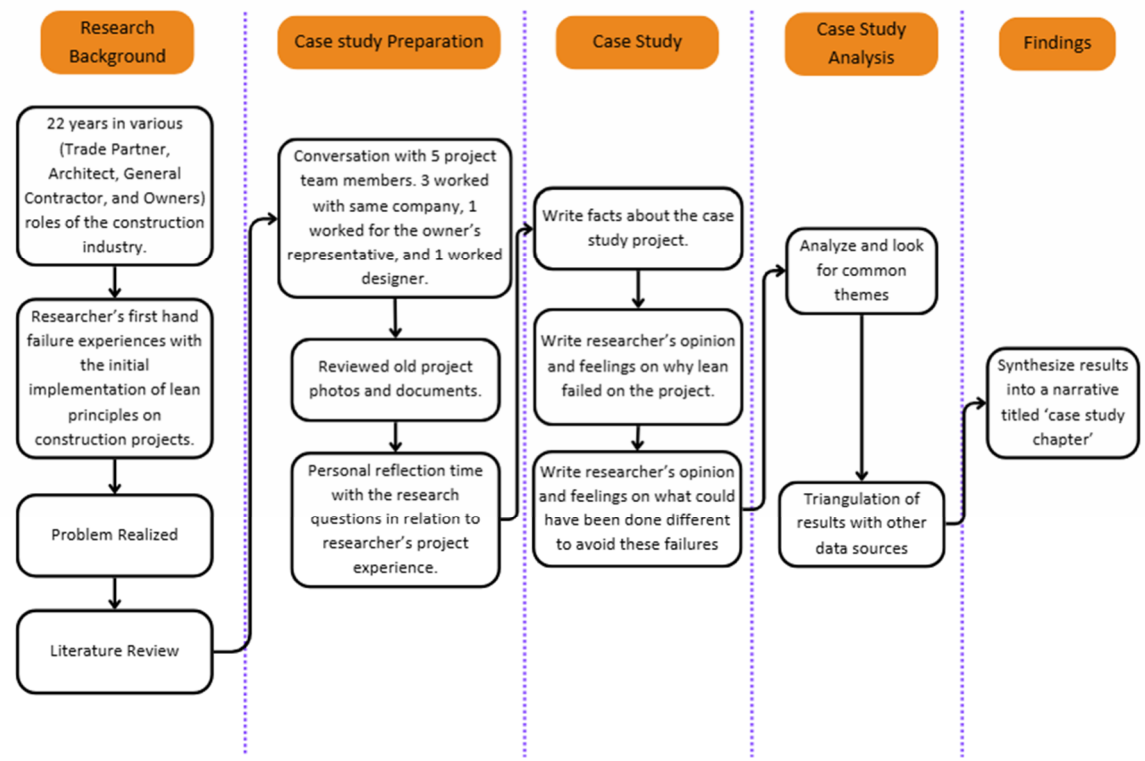

Figure 4 Case Study Methodology Flow Chart

Expert Interviews Methodology

In the journal of Applied Psychology, Hartmann perfectly described the process of interviewing as simply a "purposeful dialogue." (Hartmann, 1933) Currently, interviews stand as one of the most prevalent methods for conducting qualitative research in various fields of study. (Marvasti, 2010) Interviews are great ways to tell stories in effort to help the audience breakdown the complexities of research topics into easy to comprehend bite size pieces. (Hollway & Jefferson, 1997) Beings the research is mainly qualitative in nature, and the research seeks to understand causal relationships between

different factors and lean failure, these interviews with experts have been validated as an effective way to link causal. (Simões, 2008)

To enrich the research with diverse perspectives, the researcher has conducted semi-structured interviews with four seasoned lean leaders. Three of these lean leaders are from General Contractors who are within the top 100 General Contractors on the Engineering News Record's (ENR) Top 400 Contractors. One of these lean leaders has worked with an ENR Top 40 HVAC and Plumbing trade partner, the ENR Top Contractor for 2023, and an Owner/ Project Developer. This interviewee brought a lot of unique perspectives to the interview process. Each interview lasted approximately one hour and fifteen minutes long and probed into the interviewees' experiences with lean implementation challenges. Most of the questions were open ended which allowed each interviewee to openly think about their personal experiences with initial lean principles being implemented on construction projects. Table 1 is a snapshot of the interviewee's years of experience in construction, education, location, and current role within the industry.

Interview Participants:	Years Experience in Construction:	Education Experience:	Current Location:	Current Role:
Participant #1	20 years	BBA, Operations & Human Resource Management – Texas A&M	Dallas, TX	National Lean Practice Leader
Participant #2	22 years	MBA, Business Administration and Management – California State University	Sacramento, CA	Director, Project Delivery Services
Participant #3	8 years	BS, Industrial and Manufacturing Systems Engineering	Kansas City, MO	Lean Services Manager
Participant #4	28 years	Plumbing Apprenticeship and NCCER Master Trainer	San Antonio, TX	Principal Changemaker

Table 2 Interview Participants' Backgrounds and Professional Experience

The interviews were conducted weekly starting in August of 2023 and finishing in September 2023. The questions were derived from the case study that was completed and the interviews that came before. Additional probing and follow-up questions were asked based on the answers to the main questions.

Interview Details:	Date Time Duration Format of Interview
Interviewee Details:	Name Years of Experience in Construction Educational Experience Current Location Current Role
Consent:	Consent for video and audio recording (Yes/No)
Opening Questions:	What is your experience and background with implementing lean construction principles on a Construction project?
Main repetitive questions/statements:	Please provide an overview of the company that you work with. Please provide an overview of the company's lean journey. Please share some examples of lean culture within your organization and how they were developed. How would you describe a lean construction failure? How often have you seen lean construction fail? How do you measure the success of lean construction within your company? What are the most common reasons why lean principles fail on the first implementation of construction projects within your company? Please share some examples of lean tools or techniques that have been successful in improving project performance and reducing waste when implemented on the first lean project. Who do you engage and involved in the implementation of lean principles on your construction project? How often are front line workers engaged in the implementation of lean principles on your construction project? Did you experience any resistance to the initial implementation of lean principles on your construction project during the first implementation? If so, what did it look like and what methods did you use to overcome said resistance? Please share any innovative approaches or technologies that you have used to support the first implementation of lean principles on a construction project. What advice or recommendations would you give to organizations looking to implement lean principles on a construction project for the first time? What do you think the industry's perception of lean construction is? Please list and rank the 5 most important factors that contribute to the success of implementing lean principles on a construction project the first time. What other thoughts, opinions, or perspectives do you have when it comes to the root cause of initial implementation failure to apply lean principles to a construction project?
Closing Question:	What questions should I be asking that I did not ask you?

Table 3 Semi-Structured Interview Details and Questions

The interview process, as depicted in figure 5 below, was systematically designed to collect qualitative insights into the challenges, barriers, and failure points faced during the initial implementation of lean construction principles. Interview participants were

carefully selected through engagements with key industry bodies such as the Lean Construction Institute (LCI) and the Associated General Contractors (AGC). From a preliminary group of ten, four lean leaders were chosen for their association with ENR Top 400 firms and their willingness to provide comprehensive insights.

Interview questions were developed based on prior research, including the literature review and case study findings, with further guidance from academic advisors to ensure their relevance and depth. A total of 20 refined questions were used to facilitate a detailed exploration of participants' experiences, with interviews lasting between one and one and a half hours. Data from these interviews was transcribed and systematically coded to derive key themes. (Ryan, 1996; Krippendorff, 2018) As shown in the chart, these themes were then triangulated with other data sources, including survey and case study findings, to strengthen the validity of the conclusions drawn. This process led to a

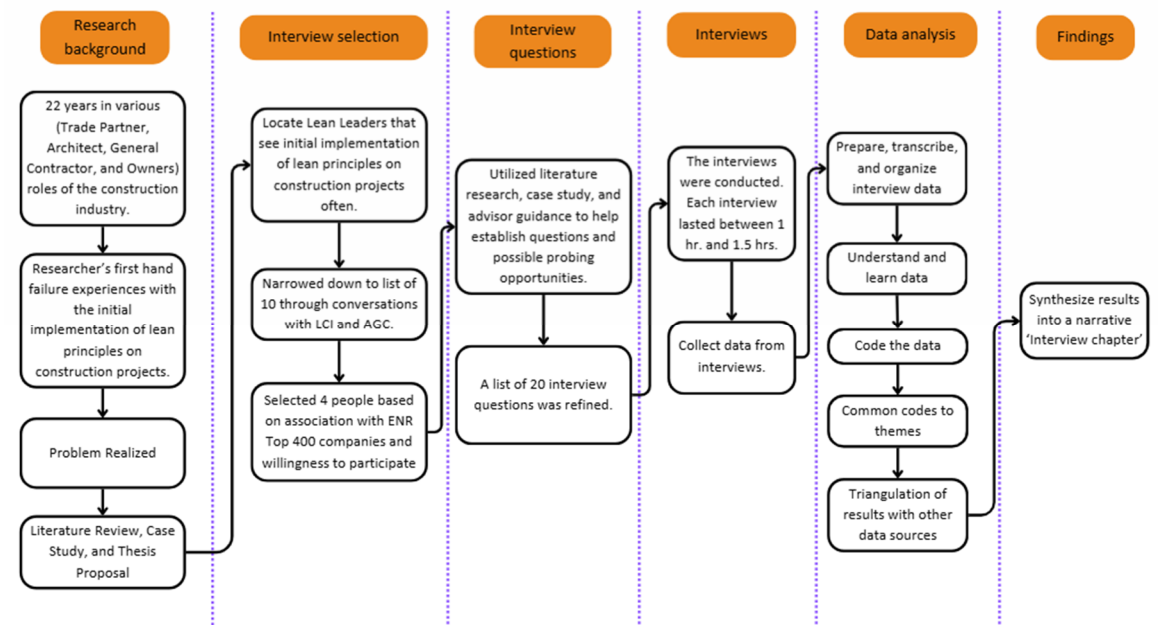

Figure 5 Interview Methodology Flow Chart

narrative synthesis of interview results, providing a detailed understanding of the complexities involved in lean construction implementation.

Industry-Wide Survey Methodology

To augment the qualitative insights derived from the case study and the expert interviews, an extensive survey was meticulously crafted and distributed via email, newsletters, and social media to a diverse cross-section of stakeholders within the construction industry throughout the United States. The objective of this survey was to systematically assess the frequency and nature of lean implementation failures, identify common obstacles, and capture a snapshot of the prevailing attitudes towards lean construction within the industry. Special efforts were made to ensure a comprehensive representation of perspectives by including a variety of respondents such as owner representatives, designers, and trade partners, thereby guaranteeing a rounded understanding of the intricacies involved in lean implementation. During this research, Qualtrics was the platform for designing the survey instrument and collecting the resulting data from participants.

The survey was designed to be concise yet comprehensive, consisting of 23 targeted questions that could be completed in under 10 minutes. The survey questions are provided for reference in Appendix A. This brevity was strategic, aiming to maximize participation rates by respecting the respondents' time constraints and reducing any potential perception of the survey as burdensome. The construction of the survey questions was informed by a blend of insights from the researcher’s case study, the initial

literature review, and the nuanced perspectives gleaned from semi-structured interviews with seasoned lean practitioners.

Survey Questions Overview

The survey embarked with basic identifiers such as the respondent's name (optional) and role within the construction industry, moving on to gauge their experience level and their familiarity with lean principles and methodologies. This was followed by questions designed to assess the respondents' self-perceived maturity in applying lean principles to construction projects and the extent of their training in this area. Respondents were then asked to reflect on their understanding of lean construction, evaluating their organization's performance in key areas and their own personal involvement in projects that sought to implement lean principles. The survey delved into the perceived effectiveness of these initial lean implementations, seeking to understand the factors contributing to both the successes and failures of these endeavors.

Further questions probed the engagement levels of trade partners in lean implementation processes and the respondents' perceptions of barriers to successful lean adoption within their organizations. The survey also sought to clarify the industry's collective understanding of lean construction principles and the current effectiveness of their application in construction projects.

Seeking to unpack the concept of 'failure' in the context of lean implementation, the survey asked respondents to define what failure meant to them, particularly in relation to initial lean implementation attempts. Furthermore, the survey investigated how the

respondents rated their initial implementation of lean principles on a construction project. In defining failure, the survey adopted a Likert scale that allowed participants to evaluate the success of lean construction implementation on a five-point scale: 1 representing "No success at all" and 5 representing "Highest degree of success." This approach provided a structured way to gauge respondent perceptions of success or failure. Failure in the context of this research is understood not only as the complete absence of success but also as any significant shortfall in fully integrating or leveraging lean principles during the first implementation attempt. Specifically, ratings of 1 ("No success at all") and 2 ("A little success") were considered clear indicators of failure, often tied to issues such as the misuse of lean tools, lack of trust, and insufficient stakeholder buy-in. Ratings of 3 ("Neutral") indicated projects that were neither failures nor successes, typically characterized by fragmented or superficial application of lean principles. Even ratings of 4 ("Successful but room for improvement") suggested incomplete adoption, underscoring the pervasive challenges in applying lean principles effectively. Finally, a 5 (“Highest degree of success”) was the representation that lean principles were fully integrated and leveraged on the project. By measuring these various degrees of failure and success, this research provides a clearer understanding of how frequent and why lean implementation falters, offering valuable insights for future lean efforts.

This attempt to further define failure was complemented by questions exploring the respondents' optimism regarding the potential for future successful lean implementations based on lessons learned from past failures. The survey concluded with a query inviting participants to rate the impact that addressing the root causes of lean

implementation failures could have on enhancing the construction industry's perception of lean construction. Additionally, respondents were asked to rank various factors in terms of their significance in contributing to the success of lean construction implementation.

This comprehensive survey was not only critical in corroborating the qualitative findings from the case study and interviews but also instrumental in painting a broader picture of the landscape of lean construction implementation across the industry. By intertwining personal anecdotes, expert insights, and broad-based survey data, this research endeavors to forge a nuanced understanding of the challenges facing lean construction implementation and to chart a course towards more effective and sustainable lean integration in construction projects. Below, figure 6 illustrates the value flow from survey creation to findings.

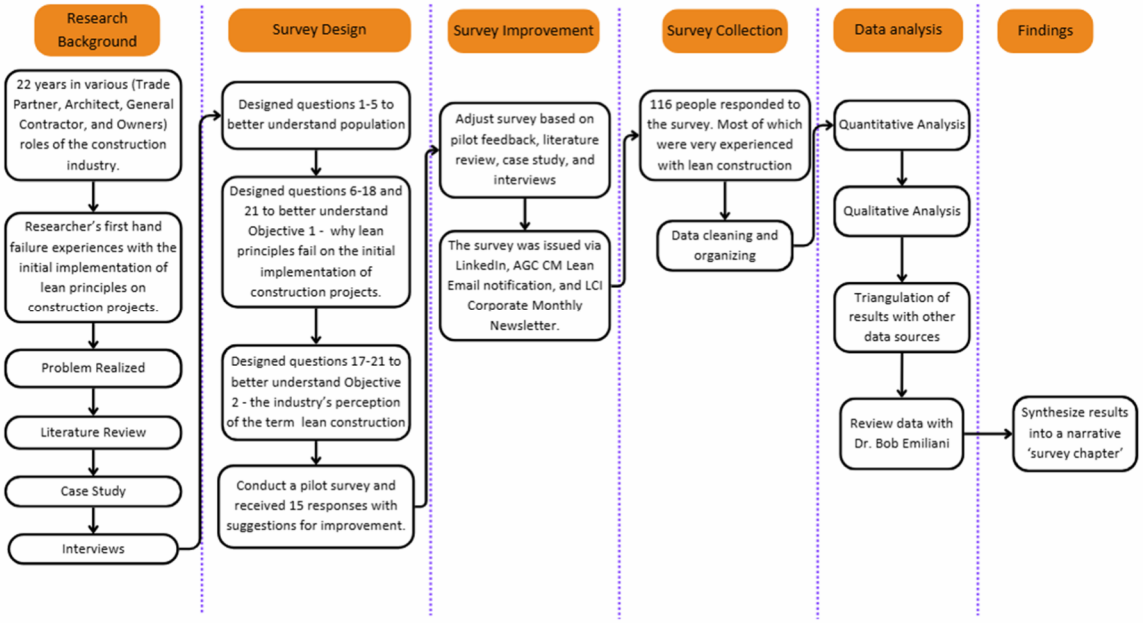

Figure 6 Survey Methodology Flow Chart

Data Analysis Methodology

This research utilized a mixed-methods approach, incorporating a triangulation of qualitative and quantitative data to explore the initial failures of lean construction implementation on projects. Building on the framework laid by Creswell (2018), this approach combined both qualitative and quantitative methods to enhance the depth and validity of the findings. Specifically, the data analysis integrated insights from case study analysis, semi-structured interviews, and an industry-wide survey. Triangulation can also be effectively achieved through the integration of qualitative data from multiple sources, such as case studies, interviews, and surveys, without relying on statistical analysis. As noted by (Leech, 2007), data analysis triangulation involves utilizing different qualitative tools and perspectives to enhance the depth and validity of the findings. By examining the convergence of themes across distinct data collection methods, a more comprehensive understanding of the phenomenon can be developed. In this study, the triangulation of qualitative insights from case studies, interviews, and survey responses helps corroborate findings and establish the consistency of emergent themes, thereby ensuring robustness and credibility without the need for complex quantitative measures. This approach allows for a unique, holistic view of the factors impacting lean construction implementation by validating the themes through various qualitative lenses.

The data analysis process followed a systematic flow beginning with data collection, where survey responses, interview transcripts, and case study notes were gathered and organized. The data was then cleaned, removing incomplete or irrelevant information to ensure quality analysis.

Quantitative analysis was conducted on survey data, with descriptive statistics (mean, frequency, etc.) calculated for each question. This enabled the identification of trends and outliers across responses, providing an overview of industry-wide perceptions.

In the qualitative analysis phase, thematic analysis was employed to interpret interview transcripts, following guidelines by Kvale and Brinkmann (2009). Themes were developed and interview data was grouped accordingly, allowing a deeper understanding of challenges like trust, leadership, and social dynamics. Case study notes were analyzed to extract examples supporting these themes, providing a rich, context-specific view of lean implementation failures.

In this study's methodology, thematic analysis draws on foundational approaches from Ryan and Weisner (1996) and Krippendorff (2018) to establish a rigorous framework for understanding the primary themes in lean construction implementation challenges. One of the primary methods employed is frequency analysis, where commonly mentioned terms or phrases across participant responses are identified and examined. This approach aligns with Ryan and Weisner's (1996) findings, which demonstrate that high-frequency terms often reveal topics that participants find particularly meaningful. In the context of this research, terms like "trust," "resistance," and "efficiency" frequently emerge, highlighting recurrent concerns and focal points in lean construction practices. Analyzing these frequent terms provides insight into the elements that industry professionals perceive as central to the success or failure of lean implementation.

The Key Words in Context (KWIC) technique, another component of Ryan and Weisner's (1996) methodology, is utilized to examine not only the frequency of key terms but also the specific contexts in which they are discussed. This ensures that identified themes reflect both the quantitative significance and the qualitative nuances of participants' perspectives. For instance, by analyzing how "buy-in" or "trust" is framed, whether positively or negatively, this study gains a richer understanding of whether these elements act as enablers or barriers to lean construction. This contextual analysis helps tie themes directly to participant experiences and adds depth to the thematic findings.

Systematic coding practices outlined by Krippendorff (2018) are also applied to enhance the reliability and replicability of the analysis. Predefined categories including Human-Centric (HC), Process (P), and Resource (R) are applied consistently across the data. This structured coding approach ensures transparency in how themes are identified, supporting consistent interpretation across interviews, survey responses, and case studies. Consistent coding, with clear theme definitions, strengthens the reliability of the study's conclusions by ensuring that themes accurately reflect the underlying data.

Additionally, the methodology incorporates triangulation, a key element of Krippendorff's (2018) approach, by cross-referencing themes across multiple data sources, including interviews, case studies, and surveys. This multi-source validation provides a comprehensive perspective on the barriers to and facilitators of lean implementation, as patterns confirmed across different sources increase the robustness and trustworthiness of the findings. Triangulation not only enhances the validity of this

study's conclusions but also demonstrates alignment with Krippendorff's (2018) recommendation for methodological rigor in qualitative research.

Finally, following Ryan and Weisner's (1996) approach to identifying sub-themes within broader categories allows this study to capture the nuanced aspects of failures with initial implementation of lean principles on construction projects. Within the "Process" category, for example, sub-themes such as "workflow reliability" and "Last Planner System challenges" offer a more granular view of specific lean construction practices that practitioners find difficult. This layered approach enables a deeper analysis by addressing both overarching categories and specific issues within each theme.

This thematic analysis, grounded in the approaches of Ryan and Weisner (1996) and Krippendorff (2018), provides a structured and nuanced framework for exploring the complexities of lean construction. The integration of frequency analysis, contextual examination, systematic coding, and triangulation ensures that the findings are both robust and deeply connected to participant perspectives, offering valuable insights into the human, process, and resource-related factors impacting lean implementation.

Triangulation involved comparing themes across survey, interview, and case study data to validate common patterns while identifying discrepancies and potential biases. This triangulated method not only provided a different perspective but also strengthened the reliability of the findings. This approach was inspired by Yin's (2009) advocacy for multi-method data integration to achieve greater depth in case study research. While writing the findings section of the paper, the research noted that the themes that had been triangulated also lined up with a paper earlier discovered on socio-

technical systems in construction (Liu, 2020). The paper was then gone through one final time to add the human-centric (HC), Process (P), and Resource (R) categories to further strengthen the argument that the need for research and experimentation should be applied to the HC category of the initial implementation of lean principles on construction projects.

Interpretation linked the quantitative survey findings with the qualitative insights from interviews and the case study. The combined data was used to connect quantitative trends to specific qualitative examples, highlighting key findings to address each research question. This process facilitated the derivation of conclusions grounded in both individual experiences and broader industry trends. This section is where Triangulation started to align all the findings from each step in the research. This step is where the categorization of themes concept came into play and the paper was written again to include this perspective on each step of research.

Ultimately, findings were synthesized into a cohesive narrative that highlighted the human-centric, process, and resource reasons that contribute to the initial failures of lean principles in construction projects. This synthesis, following the guidance of Ballard (2000) and Womack et al. (1990), was integral in framing both practical and theoretical implications, emphasizing the importance of human factors alongside technical lean practices. Below is a flow chart that illustrates how data was analyzed, triangulated, written about, interpreted, and concluded upon.

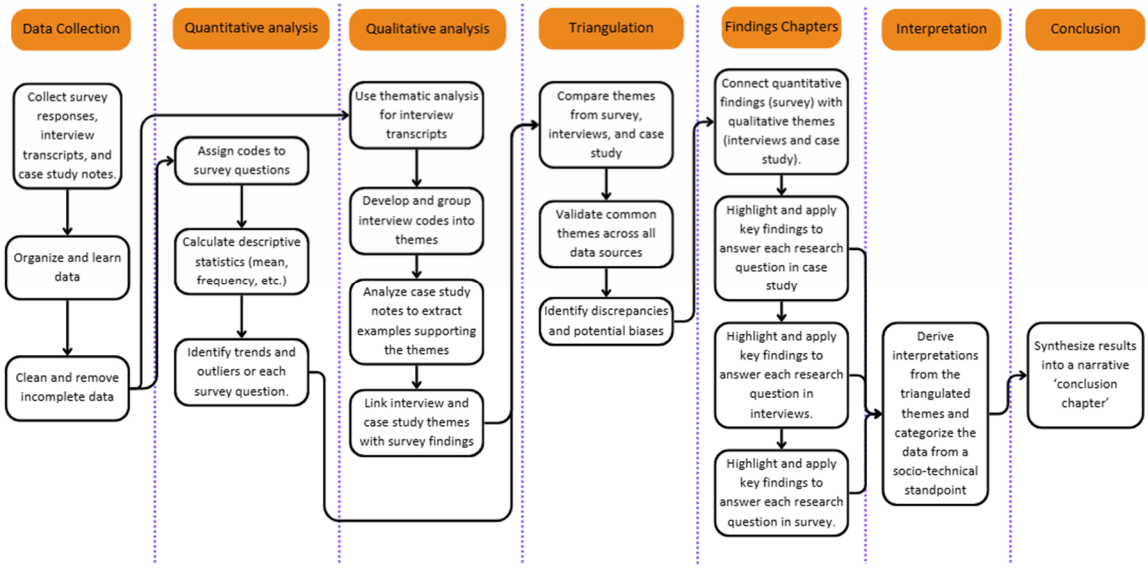

Figure 7 Data Analysis Methodology Flow Chart

Research Question 1 Methodology

Case studies are frequently employed to identify key themes and factors that shape the outcomes of systems, offering a rich, in-depth perspective on complex issues (Yin, 2009). Yin's work is ideal for understanding multi-faceted dynamics because it allows for an in-depth examination of the factors that contribute to the success or failure of a system in real life context. Yin's approach emphasizes rigor and replicability, making it highly suitable for investigating why lean principles fail on construction projects. The focus on using case studies to explore not just "how" something happens, but also "why," aligns perfectly with the objective of this research, which is to uncover the underlying reasons for the failure of lean implementation. By applying Yin's methodological framework, this thesis can provide a detailed narrative on the failure points within lean construction projects, drawing connections between leadership, trust, culture, and the misapplication of lean tools. This aligns well with the need to analyze

real-world examples in depth, such as the Higher Education Dormitory and Dining Facility project studied in this paper.

Similarly, interviews serve as a valuable tool for gaining deeper insights into these themes, allowing for a more nuanced understanding of the dynamics at play (Kvale & Brinkmann, 2009). Surveys, on the other hand, are effective in quantifying these factors across a broader population, providing a statistical overview of how certain elements influence system outcomes (Dillman et al., 2014). Triangulating qualitative and quantitative data from these methods strengthens the reliability of the findings, an approach advocated by Creswell (2018) to enhance both validity and depth in research. Each method contributes uniquely to a comprehensive understanding of the subject matter, ultimately reinforcing the systemic, technical, and human factors that influence project outcomes.

Grounded theory was employed in the analysis section of this research to systematically develop a theoretical framework based on the data collected from case studies, interviews, and surveys. This approach, following the methodology outlined by Strauss and Corbin (1990), allowed for the identification of recurring themes and patterns across different data sources. By coding and categorizing the data, grounded theory helped to reveal underlying factors contributing to the initial failures of lean construction implementation. The iterative process of comparing and analyzing the data supported the development of a theory that explains how social, technical, and cultural dynamics influence the success of lean adoption in construction projects. This method ensured that

the theory was "grounded" in the real-world experiences and perceptions of the study's participants.

Research Question 2 Methodology

For the second research question, which aimed to understand how initial failures in lean construction implementation shape the broader industry's perception and trust in lean methodologies, the researcher employed a mixed-methods approach, integrating qualitative and quantitative data collection methods. This decision was driven by the need to capture both the subjective experiences of industry professionals, and a broader statistical understanding of how lean construction is perceived across the field. The researcher used semi-structured interviews to gather in-depth qualitative insights from veteran lean practitioners, which allowed participants to share their personal experiences and the nuanced ways that early failures in lean influenced their perception of the methodology. This method was crucial in uncovering deeper themes of trust, resistance to change, and leadership challenges, all of which are central to how lean is perceived.

In addition, the researcher utilized a comprehensive industry-wide survey, which included both Likert-scale questions and open-ended responses, to quantify and generalize findings across a larger population of professionals. The survey data provided statistical insights into how common certain perceptions and challenges were, and the Likert-scale questions were particularly useful for gauging the level of agreement or disagreement with statements related to lean implementation and failure. By combining these methods, the researcher could triangulate the findings, allowing for both a broad

understanding of industry trends and a deep, context-rich analysis of individual perspectives. This approach follows Creswell's (2018) recommendation for mixed-methods research, ensuring a more holistic and valid analysis of complex issues such as the perception and trust in lean principles within the construction industry.

Categorization of Themes

The categorization of themes into Human-Centric (HC), Process (P), and Resource (R) is based on well-established frameworks within socio-technical systems theory and lean management principles. (Liu, et al. 2020) Human-Centric factors emphasize the behavioral, cultural, and leadership aspects essential for lean implementation (Mumford, 2006; Trist & Bamforth, 1951; Ballard, 2000). Process (P) factors relate to methods and practices that guide the efficient management and continuous improvement of workflows, as discussed in Koskela's (2000) Transformation-Flow-Value (TFV) theory, which underlines the need to focus on process optimization in lean implementation. Resource (R) factors involve the strategic use of tools, materials, and financial resources to achieve maximum efficiency, aligning with the principles of value delivery as highlighted in Womack and Jones' (1996) work on lean thinking. The categorization of themes was developed as the researcher was writing the triangulation portion of the conclusion chapter of this research and preparing for the thesis defense.

These categories serve as appropriate methods for analysis because they provide a structured understanding of how lean construction principles operate across different facets of a project including human dynamics, operational processes, and resource

management. Using this approach allows us to make specific conclusions regarding the failures of lean adoption, ensuring that all aspects of the implementation are addressed holistically. The references used, such as Ballard (2000), Koskela (2000), Liu (2020), and Womack and Jones (1996), support that socio-technical balance, process efficiency, and resource optimization are all critical to the successful application of lean principles. These categorizations facilitate a comprehensive analysis that acknowledges the interplay between human behavior, procedural rigor, and resource allocation, providing a unique view of what influences the success or failure of lean implementation in construction.

By applying these categorizations, one can better understand the socio-technical balance required for successful lean construction and ensure that both human and technical components are addressed. The researcher will pull themes in accordance with Ryan (1996) and Krippendorf (2018) and then apply HC, P, and R categories to the common themes for each step within the methodology, including: literature review, case study, interviews, and the industry wide survey.

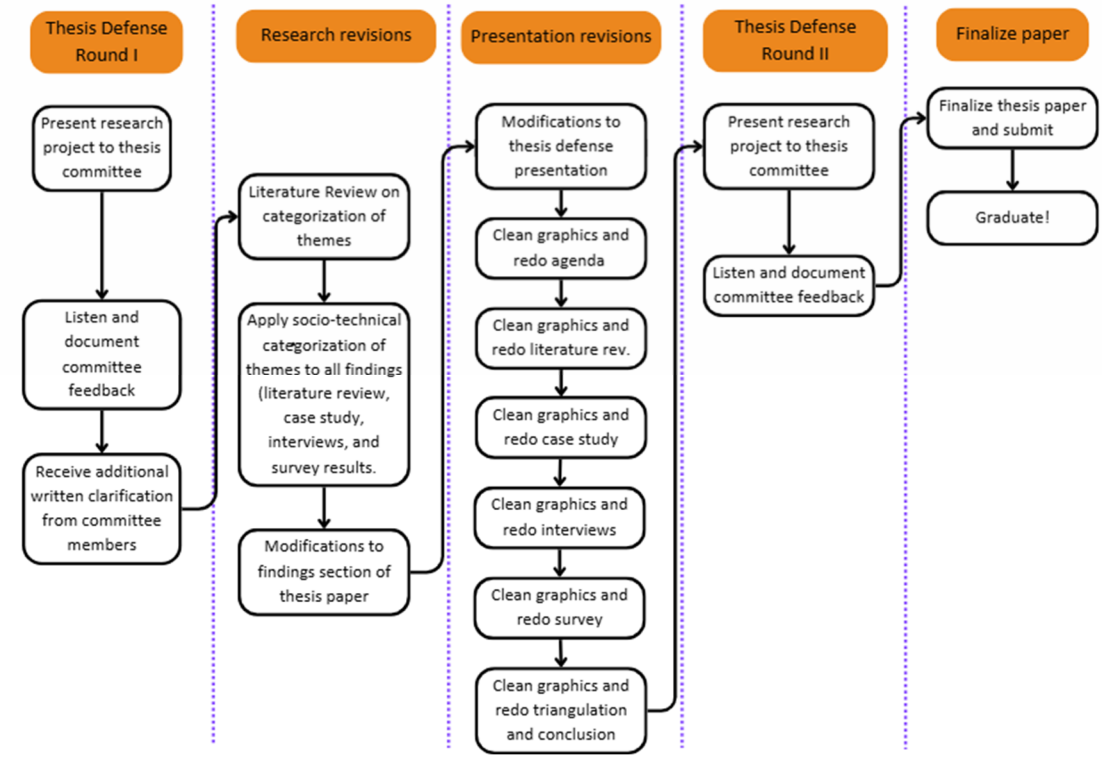

Figure 8 Categorization of Themes Flow Chart

Institutional Review Board Approval

The Institutional Review Board (IRB) approval number for both the survey and interviews is: IRB00000481 and the FWA number is: FWA00004497. These approvals can be found in Appendix F.

CHAPTER IV

CASE STUDY

Why did the initial implementation of lean principles fail at the Higher Education Dormitory and Dining Facility Construction project?

This chapter is the researcher's firsthand experience on failure with lean principles when applying to a construction project for the first time. These learnings come from the researcher's internal thoughts after years of successful implementation of lean principles on construction projects. In addition, three team members on the project were interviewed for their opinions on why lean principles were not successfully implemented on this project. Per their request, those thoughts have been integrated with the researcher's thoughts throughout this case study.

Lean Construction failed on this project. As previously mentioned, the definition for failure being applied is that the team was unable to fully integrate or leverage lean principles on this project, primarily due to the project team (Owners, Designers, Trade Partners, and Vendors) not buying in to the lean principles. In addition, the project schedule for the dining space went above and beyond the committed to date and finished roughly 6 months after the completion of the dormitory facilities. Finally, the project experienced significant budget overruns to the tune of roughly 5% of the overall project cost.

Case Study Project Description

Figure 9 Case Study Facts

This project was a higher education project in a tight location with the Physical Plant on the west elevation, 6 dormitory buildings on the south side, the fraternity and sorority quad at the north side, with the main student union center to the east. In addition, the project was located two city blocks from the highly attended football stadium. The logistics were extremely tight, and the campus was active with students for most of the time that we spent on the project site. The project was 200,000 square feet, had three dormitory towers that were 6 floors each and a 3-story dining facility in the middle of the compound. The basement and first levels were all connected while the third floors started to rise on their own.

Origins and Process of lean on the project:

The Senior leadership of the General Contractor assigned the task 'of making this project lean by applying the Last Planner System' to me (researcher), who was the MEP Project Manager for the job. The researcher was deemed as the lean champion for the project. From that point

Figure 10 Private Pull Plan Scheduling Board

forward, the researcher spent the next 6 months researching, studying, and interviewing people on how to apply The Last Planner System, while simultaneously completing the preconstruction work to buyout and procure the appropriate resources for the project. The researcher then proceeded to visualize the entire phase plan on the walls within his own office. As trades came on board, this was the area where they would be brought up to speed on what the plan and schedule was. There were also three-week boards that were in the field office conference room where the trades were held accountable to post their next three weeks' worth of activities. Next to the three-week boards in the conference room were the individual PPC% scores for each individual subcontractor. Each week at the Trade Progress meeting, the team would fill out their next 3 weeks of activities. At the end of the week, the General Contractor would 'grade' each of the Trades on how they performed that week and post their scores. There were various roles, ranging from Project Executives to Field Foreman, that were in the room during these meetings.

Why did lean principles fail on this construction site?

To systematize and visually represent the interconnected root causes of failure observed in this case study, a fishbone diagram (Ishikawa diagram) was developed. The development of this diagram was informed by the researcher's firsthand reflections, interviews with project team members, and established lean construction principles. Following Coccia's (2018) methodology, the fishbone diagram was used to identify, systematize, and analyze the sources of failure. The primary failure identified was the inability to achieve seamless trade handoffs, resulting in time and cost overruns. This

inefficiency was traced back to ineffective coordination and scheduling, which stemmed from trust deficits, insufficient team alignment, and the weaponization of metrics. By illustrating these cascading failures, the diagram emphasizes the critical role of trust in facilitating successful lean implementation. Furthermore, it underscores the necessity of addressing both human-centric and process-oriented challenges to ensure project success. The use of this structured analytical approach enables the synthesis of complex dynamics into actionable insights, offering strategies to prevent similar pitfalls in future projects.

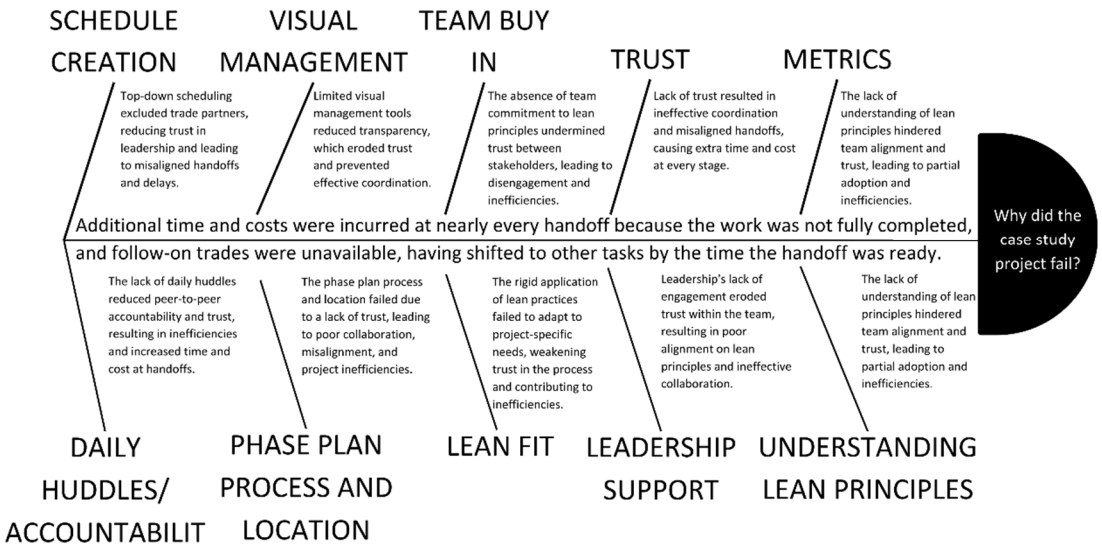

Figure 11: Fish bone diagram of root cause of case study failure

The fishbone diagram highlights nine primary areas contributing to the failure of lean principles on this project, with each category providing a unique insight into the systemic challenges faced. By examining Trust, Leadership Support, Team Buy-In, Lean Fit, Schedule Creation, Phase Plan Process and Location, Visual Management, Metrics,

Daily Huddles and Accountability, and Understanding Lean Principles in detail, we can identify the root causes and their cascading effects on project outcomes.

Trust

The Lean Champion (researcher), and the rest of the project team did not focus on building trust or relationships. Lean (Last Planner System) was only being used as a tool to drive production on the project. People were only a means to get the project built and there was no opportunity to learn or innovate on the project. The project leadership team was not transparent with information and how or why decisions were made.

Root Cause of Failure: The lack of focus on building trust among team members resulted in an inability to fully integrate lean principles, as relationships were not prioritized, and transparency was lacking. Lean practices, such as the Last Planner System, were used merely to drive production rather than foster engagement, leaving project timelines inefficient and hindering genuine collaboration. This shortfall in trust led to disengagement and a reversion to conventional methods, undermining the project's lean goals and ultimately impacting team morale, stakeholder satisfaction, and the project's reputation.

Leadership Support

Senior Project Leadership forced the project team to apply lean (Last Planner System) principles. The Senior Project leadership team did not participate in the meetings, process, or even acknowledge that these lean activities were taking place.

Root Cause of Failure: Senior project leadership's lack of active involvement created a disconnect between lean goals and daily project activities. By mandating lean principles without participating in or validating these practices, leadership failed to support full integration of lean principles. This absence of engagement from leaders contributed to budget overruns and schedule inefficiencies, as team members lacked guidance and commitment to maintain lean practices. Consequently, the project experienced performance shortfalls and further eroded trust in lean methodologies among stakeholders.

Team Buy In

The internal team never fully bought in to the lean principles. Due to the General Contractor team not buying in fully, the trade partners, vendors, and other stakeholders followed suit.

Root Cause of Failure: The internal team's incomplete commitment to lean principles weakened the lean initiative's integration and adoption. Without a unified approach, trade partners, vendors, and other stakeholders mirrored this lack of buy-in, resulting in partial or superficial lean application. This failure to align the project team on lean principles led to ineffective planning, disengagement, and eventual abandonment of lean tools, impacting project timelines, costs, and stakeholder confidence.

Lean Fit

The Lean Champion (researcher) read several white papers and tried to force the project to fit within lean standards identified in those white papers (Ballard, 2000). In

other words, the researcher read the white papers as a prescription for a recipe that must be followed directly with limited or no variation.

Root Cause of Failure: The rigid application of lean principles based on theoretical standards created an inflexible approach that failed to adapt to project-specific needs. This approach limited the project team's ability to leverage lean principles effectively, as the practices did not fit the unique project context. This inability to adapt led to project inefficiencies, missed performance metrics, and a return to traditional practices, impacting both the project outcomes and the reputation of lean construction in this context.

Schedule Creation

The General Contractor team forced their schedule onto the Trades. The schedule was completed by the General Contractor's Senior Project Leadership team prior to have ever receiving a set of drawings. The framework of that schedule was stuck to throughout the entire project without allowing the people who were doing the work to participate in the planning of the work.

Root Cause of Failure: The top-down imposition of schedules, without consulting those responsible for executing the work, inhibited the integration of lean principles. This exclusion of critical input led to a misaligned schedule that could not accommodate real-time project needs, resulting in timeline inefficiencies and a reversion to traditional scheduling practices. The forced schedule ultimately failed to meet performance

expectations, creating lasting repercussions on project cohesion and trust among stakeholders.

Phase Plan Process and Location

The Lean Champion (researcher) had all the answers to how the plan and schedule would go on a wall tucked away in his own office. The researcher had broken down the areas into smaller zones and planned to flow people through space; however, none of that information was made visible to the public. Furthermore, this information would have been used to validate a plan and/or pull information from the trade partners to better perfect the plan.

Root Cause of Failure: Centralizing phase plans within the Lean Champion's office hindered transparency and discouraged team engagement in the planning process. By not involving all stakeholders and lacking accessible visual management, the project was unable to fully integrate and leverage lean principles, leading to inefficiencies and a partial abandonment of lean practices. This lack of visibility and inclusion in planning limited project success and impacted team morale and stakeholder satisfaction.

Daily Huddles and Accountability

The project team did not host daily huddle meetings and there was a lack of accountability among the project team. When someone would plan something and not execute their plan, the typical response was 'ok', when are you going to finish it now. There was no coming together and holding each other accountable from a peer-to-peer perspective.

Root Cause of Failure: The absence of regular daily huddles and clear accountability structures led to a breakdown in peer-to-peer support and collaboration. Without daily check-ins to monitor progress and hold each other accountable, the project could not fully integrate lean principles, resulting in inefficiencies, disengagement, and abandonment of lean tools. The lack of accountability led to performance shortfalls and a reversion to traditional management practices, impacting project success and stakeholder trust.

Visual Management

The only visual boards used were the 3 week look ahead in the conference room, the PPC% boards, and the full Phase plan in the Lean Champion's office. Roadblock, Deliveries, Floor plans, Quality, Milestones, and other boards were not created to assist in delivering the required flow of the trades for project success.

Root Cause of Failure: Limited use of visual management tools prevented the transparency necessary to maintain lean practices and enhance team engagement. By failing to make workflow and project status visible, the team struggled to integrate and leverage lean principles effectively, leading to inefficiencies in project timelines and a reversion to conventional approaches. This failure in communication tools impacted stakeholder confidence and the potential benefits of lean construction practices.

Metrics

The PPC% (Planned Percent Complete) was broken up and shown as individual contractors in lieu of a team score. This promoted some people to weaponize this metric

against the trade partners. Once the metric was weaponized against a few contractors, the metric became useless. People learned how to take advantage of the metrics to modify their intended outcomes. One person could have (1) 5-day activity and only fail on Friday and have a 0% or one person could have (5) 1-day activities and only fail on Friday, producing an 80% statistic. This was quickly realized and used to the advantage of the Trade Partners on the project.

Root Cause of Failure: The individual-focused metrics, rather than team-oriented ones, led to manipulation of the PPC (Planned Percent Complete) metrics, which undermined collaborative goals and accountability. This "weaponization" of metrics contributed to disengagement and a superficial application of lean principles. The failure to maintain transparent, team-focused metrics prevented the project from achieving its expected performance metrics, resulting in a partial abandonment of lean practices and impacting stakeholder trust and project success.

Understanding Lean Principles

Lean principles were not fully understood by all project team members. There was no effort to understand the first principles and theory of lean prior to applying the lean principles. The researcher believes that this is one of the key revelations that was taken from this project and used to get more people to apply lean up front. People must understand why they are doing something if they are going to be motivated and inspired to continue to do that thing.

Root Cause of Failure: The team's lack of understanding of core lean principles limited the integration of lean practices and led to a surface-level application. Without a thorough understanding of lean's foundational theories, team members were less motivated to maintain lean practices, resulting in early abandonment and performance inefficiencies. This lack of understanding impeded the project's ability to meet expected metrics, ultimately affecting stakeholder satisfaction and the long-term reputation of lean implementation within the construction firm.

Each factor's failure to achieve full integration and leverage of lean principles led to various negative outcomes, including inefficiencies, cost overruns, and the abandonment of lean practices. This analysis has highlighted essential components such as trust, leadership support, team commitment, contextual adaptability, transparency, and accountability as fundamental to the successful integration and sustained implementation of lean principles on construction projects.

What could have been done to avoid these causes of failure?

Looking back on this project, with more than 12 years of lean construction experience since, the researcher knows there are several things that could have been done to combat each one of these points of failure to initially implement lean principles on the project. This portion of the paper will address each of the points of failure along with ways for teams to combat these potential points of failure in the future.

Trust

To build trust among the team, it is essential to foster open communication and empower trade partners to participate fully in decision-making. For example, all planning meetings should begin with an activity or icebreaker that encourages every stakeholder to share their thoughts openly. This helps create an environment where individuals feel valued and heard. Additionally, it should be explicitly stated that trade partners are encouraged to voice concerns, including saying “no” when necessary, to ensure transparency and realistic commitments. These steps cultivate psychological safety and mutual respect, which are foundational to trust.

Leadership Support

To ensure leadership effectively supports lean implementation, senior leaders must actively engage in the process rather than mandating it without involvement. For instance, leaders can attend daily huddles or planning sessions to demonstrate their commitment and model desired behaviors. This engagement signals to the team that lean principles are a shared responsibility rather than an imposed directive. By fostering alignment between leadership and the project team, trust is strengthened, and resistance to lean practices is reduced. As an example, on a similar project with active leadership participation, team engagement improved, and lean practices were sustained throughout the project lifecycle.

Team Buy In

To achieve full team buy-in, the General Contractor (GC) must actively involve trade partners in the planning process, allowing them to share their insights and concerns openly. For example, GCs can hold collaborative planning sessions where trade partners are encouraged to outline their strategies for completing specific tasks. This inclusive approach ensures that all stakeholders feel ownership of the plan, making them more committed to its execution. Empowering trade partners fosters trust and accountability, as demonstrated in projects where inclusive planning led to higher engagement and fewer schedule disruptions.

Lean Fit

Lean principles must be tailored to the specific needs of each project, rather than rigidly applied. For example, the Lean Champion should adapt tools like the Last Planner System to fit the project's unique constraints and goals. By framing lean as a flexible framework rather than a strict rulebook, project teams can focus on outcomes rather than compliance. For instance, on a past project, customizing pull planning sessions to align with team preferences improved participation and trust, demonstrating that lean can be adjusted without sacrificing its core principles.

Schedule Creation

Schedules should be developed collaboratively, with trade partners providing input from the outset. For example, during preconstruction, GCs can host scheduling

workshops where trade partners validate and adjust timelines based on their expertise. This ensures the schedule reflects real-world conditions, reducing the risk of delays. Collaborative scheduling builds trust by valuing trade partners' knowledge, as seen in projects where co-created schedules resulted in fewer conflicts and greater adherence to milestones.

Phase Plan Process and Location

The phase planning process should include trade partners from the beginning and make all plans publicly visible. For example, phasing plans can be displayed in a shared workspace where all stakeholders can access and update them as needed. This transparency ensures alignment and promotes trust among team members. On a similar project, making the phase plan highly visible allowed trade partners to anticipate and resolve potential conflicts, improving coordination and reducing rework.

Daily Huddles and Accountability

Daily huddles should be mandatory and structured to foster accountability and collaboration. For example, teams can use a standardized agenda to review progress, identify roadblocks, and assign tasks for resolution. These meetings ensure that everyone is aligned and accountable for their commitments. In previous projects, consistent huddles significantly reduced miscommunication and improved trust, as team members could see progress and actively contribute to problem-solving.

Visual Management

Effective visual management tools provide a shared understanding of project status and help depersonalize challenges, fostering collaboration. For example, using roadblock boards to track issues such as delivery delays or quality concerns allows teams to collectively address problems rather than assigning blame. This approach fosters trust by ensuring transparency and shared accountability. Other tools, such as safety boards or innovation boards, can also drive engagement by highlighting team priorities and encouraging contributions from all project members. A well-designed visual system transforms abstract discussions into actionable insights, improving communication and collaboration.

Roadblock boards assist the project team with becoming fanatical roadblock removal experts. These boards track the roadblock description, current action, expected resolution and name of person driving accountability. Delivery Boards assist the project team with understanding who will be delivering resources to the project. Oftentimes the project team needs to coordinate logistics and/or equipment in effort to offload deliveries. Project Drawings hung on the wall allow for deeper conversations around who is working where, storing materials where, and how they will be accessing those areas. This is another level of communication as opposed to talking about it. Quality boards allow us to visualize the acceptable standard of the project. These are often focal points of the owner and/or design team. Safety boards allow us to communicate the top 3 hazards on the project site and how we are doing collectively as a team on working safe. Innovation boards allow all project stakeholders (executives to laborers) the ability to write ideas on

a board to improve the construction delivery. The author has plenty of other visualization ideas to help project teams based on their individual needs and would be happy to provide more details if contacted.

Metrics

Metrics should be designed to promote collaboration rather than competition. For example, instead of focusing on individual PPC (Planned Percent Complete) scores, teams should track collective progress and use metrics to identify systemic issues. Reflecting on root causes of failure rather than assigning blame fosters a culture of continuous improvement. On a past project, shifting to team-oriented metrics increased transparency and trust, as teams worked together to improve outcomes rather than focusing on individual performance.

Understanding Lean Principles:

All team members should receive training on the foundational principles of lean, with an emphasis on respect for people. For example, onboarding sessions can include testimonials or case studies from successful lean projects to demonstrate its benefits. Providing this context ensures team members understand the "why" behind lean practices, motivating them to adopt these principles. In projects where lean was introduced with a focus on its human-centered approach, teams showed greater engagement and commitment to implementing lean tools effectively.

The lack of understanding of lean systems among the internal project team and trade contractors, compounded by inadequate communication and trust, highlights the

critical importance of proper preparation and alignment of all stakeholders prior to implementing lean principles. The comments from senior leadership and project team members, such as “lean made the project worse” and “that lean stuff was a joke,” reflect the disillusionment and frustration that can arise when lean practices are introduced without sufficient understanding or contextual adaptation. These remarks serve as a stark reminder of the consequences of neglecting foundational elements such as trust, shared purpose, and effective communication.

While these challenges reveal significant shortcomings in the implementation of lean practices on this project, they also provide valuable insights for future endeavors. The recommendations outlined in this section, including fostering trust, ensuring leadership engagement, adapting lean practices to project-specific contexts, and providing comprehensive training, offer a pathway to mitigate similar failures. This analysis underscores the necessity of viewing lean construction not as a prescriptive set of tools but as a collaborative and cultural transformation. For lean principles to succeed, project teams must commit to building trust, promoting shared accountability, and cultivating an environment of continuous learning and improvement.

Categorization of Themes

Case Study Theme	Category
Trust	HC
Leadership Support	HC
Team Buy-In	HC
Lean Fit	P
Schedule Creation	P
Phase Plan Process and Location	P
Daily Huddles and Accountability	P
Visual Management	P
Metrics	R
Understanding Lean Principles	HC

Table 4 Categorization of Case Study Themes

In this section, the themes derived from the case study have been categorized consistently with the definitions of Human-Centric (HC), Process (P), and Resource (R) used throughout the thesis. Human-Centric factors relate to behaviors, relationships, and leadership dynamics crucial for successful lean implementation. Process factors are concerned with the methods and practices guiding workflow management and efficiency. Resource factors focus on the strategic use of materials, tools, and financial resources to optimize construction outcomes. This categorization ensures a comprehensive understanding of the factors influencing lean implementation by considering the interplay between people, processes, and resources.

The categorization of the major themes from the case study into Human-Centric (HC), Process (P), and Resource (R) helps to reveal the contributions of various elements in the lean construction process. The theme of Trust was categorized as Human-Centric because it revolves around the relationships, transparency, and interpersonal dynamics within the project team. The lack of emphasis on building trust and relationships had a

detrimental impact on team cohesion and overall engagement, making it a human-centered issue. Similarly, Leadership Support and Team Buy-In were also categorized as Human-Centric. Leadership support, in the context of this analysis, refers to the active behavior and direct involvement of senior project leaders in implementing lean principles. This definition emphasizes their engagement with the team and processes, as opposed to situations where their focus or resources were directed elsewhere. While leadership's strategic prioritization may occasionally shift attention away from lean practices, this analysis categorizes leadership support specifically based on its direct impact on team alignment and the successful integration of lean principles. The absence of active involvement from leadership was identified as a critical factor contributing to the project's challenges. Their lack of participation and acknowledgment directly impacted team morale and trust. Team buy-in emphasizes the attitudes and motivation of the team toward lean principles, where the internal team's resistance affected other stakeholders, underscoring the importance of people-centered engagement in the successful implementation of lean principles.

Understanding Lean Principles is categorized as a Human-Centric factor in this analysis because it involves ensuring that team members fully comprehend the purpose behind lean practices, which is essential for fostering commitment and motivation. It could be argued that this factor aligns with Process if understanding is considered a function of a structured training approach; however, the focus here is on the human dimension of learning and internalization. This categorization emphasizes the critical role

of individual engagement, perceptions, and collaboration, which were key contributors to the challenges observed in the project.

On the other hand, themes like Lean Fit, Schedule Creation, Visualization, Phase Plan Process and Location, and Daily Huddles and Accountability were categorized under Process. These themes are primarily concerned with the planning, methodologies, and procedural aspects of managing and executing the project. Lean Fit reflects the rigid application of lean principles without adjusting to the specific needs of the project, highlighting a procedural challenge. Schedule Creation was imposed without collaboration from those performing the work, emphasizing a process-focused issue around planning and workflow. Visualization, Phase Plan Process and Location dealt with the development of the plan and schedule, which was not effectively communicated to the broader project team, leading to inefficiencies in implementation. Daily Huddles and Accountability were absent from the project, and the lack of regular meetings and accountability structures prevented a cohesive approach to executing the project plan, making it a procedural issue.

Themes such as Metrics, cost, and schedule limitations are integral to project management, but their categorization requires careful consideration. Metrics like Planned Percent Complete (PPC%) could reasonably be argued as part of the Process category, given their role in monitoring workflow and guiding decision-making. However, in this analysis, metrics are categorized as Resource because they provide the quantitative data necessary to inform resource allocation decisions, such as labor and time distribution. While metrics themselves are not the decision-making process, they are critical tools that

shape how resources are managed. Misuse of these metrics undermined effective communication and accountability, which in turn negatively affected project outcomes by creating misaligned expectations and inefficiencies. This categorization reflects the dual role of metrics as both inputs to and reflections of resource management strategies.

Each of these categories: Human-Centric, Process, and Resource has been defined and supported by academic literature to ensure that the analysis of lean implementation failures is comprehensive and grounded in established theoretical frameworks. For instance, the emphasis on leadership and team trust aligns with socio-technical systems thinking, as noted by Mumford (2006) and Trist & Bamforth (1951), while the focus on efficient processes reflects Koskela's (2000) theories on lean workflows

Summary of case study

This case study analysis of the application of lean principles on a Higher Education Dormitory and Dining Facility Construction project provides a comprehensive analysis of why the initial implementation of lean principles failed. This project, set in a highly complex and constrained environment, faced numerous challenges that ultimately led to the abandonment of lean principles by the project team. A few of the team's failure points included issues of trust, leadership support, team buy-in, and misalignment of lean tools to the project's specific needs.

The project team did not fully understand what they were doing with the initial implementation of lean principles. In addition, no one truly had a full definition of what lean was. The absence of a coach or guide resulted in a lack of focus or interest in respect

for people and value creation. The misapplication of lean principles led several team members to develop a negative perception of lean construction. The project emphasized being lean rather than using lean tools and principles to add value. Moreover, the Lean Champion attempted to force the project to fit within existing lean research guidelines rather than adapting lean principles to meet the project's specific needs. The Lean Champion's rigid adherence to theoretical frameworks created a disconnect between the practical realities of the project and the intended benefits of lean principles. This inflexibility alienated team members, fostering resistance to lean methodologies and ultimately undermining the potential for successful implementation.

Causes of failure included the lack of trust and transparent communication within the team, inadequate leadership support, and insufficient team buy-in. The improper use of visual management tools and metrics further exacerbated these issues. The failure to host daily huddle meetings and the weaponization of metrics against trade partners undermined the potential benefits of lean practices. Each category H, P, and R was a contributing root cause of failure.

To prevent failures like those observed in the case study from recurring, future projects must place a strong emphasis on fostering a cohesive team environment where lean principles are not only understood but believed in and embraced by all stakeholders. The use of effective visual management tools and appropriate metrics, designed to encourage rather than control, coupled with a flexible and adaptive approach to lean implementation, can create a foundation for continuous improvement and collaborative success. By fostering a unified team mindset, utilizing adaptive tools and metrics, and

tailoring lean principles to project-specific needs, these strategies minimize resistance, enhance collaboration, and establish a framework that promotes success and reduces the likelihood of failure.

Prioritizing the well-being, respect, and empowerment of workers can contribute to improved engagement, trust, and collaboration, which are widely recognized as essential elements for effectively implementing lean principles and achieving sustained project success. However, this perspective is based on the researcher's observations and professional experience rather than data or analysis derived from this study, highlighting the need for further research to substantiate these methods for avoiding failure. Prioritizing the well-being, respect, and empowerment of workers ensures their engagement, trust, and collaboration, which are essential for effectively implementing lean principles and achieving sustained project success. The case study demonstrates that the success of lean construction is rooted in fostering trust, engagement, and a shared vision for improvement among all team members. The absence of leadership flexibility, genuine buy-in, and a clear focus on respect for people led to disengagement and resistance, ultimately undermining the project's potential. These findings highlight that human-centric elements are not supplementary but foundational to effectively implementing lean principles and achieving sustainable project success.

CHAPTER V

INTERVIEW FINDINGS

A As identified in the research methodology, upon completion of the case study, the researcher conducted four interviews with Lean Champions who have worked with some of the largest construction firms in the United States. These interviews were semi-structured, allowing participants to describe their experiences with lean construction using their own words and perspectives. Analysis of the interview transcripts (see Appendix A, B, C, and D) revealed five recurring themes that illuminate the complexities of implementing lean principles, particularly on first-time projects. These themes not only highlight the shared and divergent experiences of the participants but also informed the development of survey questions aimed at exploring lean construction's application and perception within the industry.

Theme 1: The Importance of People and Culture

A consistent theme across the interviews was the prioritization of people and culture in lean implementation. Participant #1 (National Lean Practice Leader with 20 years of experience) emphasized integrating new hires into the lean culture as a foundational step, while Participant #3 (Lean Services Manager with 8 years of experience) highlighted the need to focus on building high-performing teams. Participant #4 (Principle Changemaker with 28 years of experience) discussed the importance of empathy in cultivating a lean culture on construction sites. These perspectives align with the case study's findings that a lack of trust and respect for people undermined team engagement and collaboration. The interviews reinforced the idea that successful lean implementation depends on

fostering a culture where workers feel valued and empowered, a concept reflected in the survey questions related to team engagement, leadership buy-in, and cultural integration.

Theme 2: Resistance and Adaptation

Resistance to lean implementation emerged as a significant challenge in the interviews, with participants citing factors such as lack of understanding, negative past experiences, and fear of change. Participant #3 and Participant #4 both highlighted the importance of trust-building, clear communication, and addressing specific pain points to overcome resistance, which echoes findings from the case study. The case study observed that rigid and poorly contextualized approaches to lean led to disengagement, a pattern that aligns with the interview participants' emphasis on adaptability and trust as essential for addressing resistance. These insights informed survey questions exploring the root causes of resistance, strategies for overcoming it, and the role of leadership in mitigating challenges.

Theme 3: Definition and Perception of Failure

The interviews revealed varying perspectives on what constitutes failure in lean construction. For Participant #1, failure involved the weaponization of lean principles, while Participant #2 (Project Delivery Services Director with 20 years of experience) defined it as a violation of the respect for people principle. Participant #4 described failure as giving up on lean efforts, and Participant #3 identified it as the inability to adjust tools to project-specific needs. These nuanced views resonate with the case study's findings, particularly regarding rigid adherence to frameworks and lack of leadership support as primary failure mechanisms. The differing perceptions of failure informed

survey questions aimed at understanding participants' definitions of failure and their lessons learned from unsuccessful implementations.

Theme 4: Measurement of Success and Continuous Improvement

The interviews highlighted the importance of measuring success and embracing continuous improvement. Participant #3 used a 5-point scale to evaluate lean project engagement, while Participant #4 emphasized "light bulb moments" as indicators of internal progress. These diverse approaches to measuring success align with the case study's emphasis on the necessity of ongoing evaluation and feedback. However, while the case study focused on the misuse of metrics such as PPC%, the interviews expanded this perspective by discussing the broader role of measurement in driving improvement. Survey questions related to lean success metrics and the value of continuous improvement processes drew directly from these discussions.

Theme 5: Innovations and Approaches for First-Time Implementation

Innovative strategies for first-time lean implementation emerged as a key theme in the interviews, with participants emphasizing the use of technology, visual controls, and stakeholder engagement. For example, Participant #2 focused on building trust as a foundation for lean adoption, while Participant #3 utilized online collaboration tools to enhance communication. These insights complement the case study's findings, particularly the observation that inclusive planning processes and transparency are critical to overcoming initial barriers to lean implementation. Survey questions related to innovative practices and first-time implementation strategies were shaped by these discussions.

Theme (from Interviews)	Unique Interview Contributions	Case Study Insights (Aligned)
The Importance of People and Culture	Emphasis on empathy, integration of new hires into lean culture, and the human element of building high-performing teams.	Lack of trust and respect for people undermined team engagement and collaboration, contributing to project challenges.
Resistance and Adaptation	Trust-building, clear communication, and addressing local pain points as strategies to overcome resistance.	Rigid application of lean principles led to disengagement and resistance due to lack of contextual adaptation.
Definition and Perception of Failure	Multiple definitions of failure, including weaponization of lean principles and failure to adjust tools to project-specific needs.	Failure was linked to rigid frameworks, lack of leadership support, and abandoning lean efforts mid-project.
Measurement of Success and Continuous Improvement	Emphasis on qualitative measures such as 'light bulb moments' and internal progress, in addition to quantitative metrics.	Misuse of metrics such as PPC% undermined accountability and communication, reducing project efficiency.
Innovations and Approaches for First-Time Implementation	Use of technology, visual controls, and stakeholder engagement to support lean adoption.	Inclusive planning and transparency were identified as critical for overcoming barriers to first-time implementation.

Table 5 Alignment of Interview Themes with Case Study

The alignment between interview themes and case study findings reinforces the central importance of human-centric factors, adaptability, and a shared understanding in the success or failure of lean construction. Theme 1, focusing on people and culture, aligns closely with the case study's emphasis on trust and respect for people, underscoring how a lack of empathy and cultural integration can hinder engagement. Theme 2, resistance and adaptation, parallels the case study's critique of rigid lean implementation approaches, highlighting the need for flexibility and trust-building to overcome barriers. Theme 3, definitions of failure, provides additional context to the case study's findings on the misapplication of lean principles and leadership deficiencies. Themes 4 and 5 expand upon the case study by emphasizing the role of tailored

strategies, continuous improvement, and innovative practices in addressing implementation challenges.

While some connections between the interviews and case study findings may appear less direct, the themes collectively underscore the interconnectedness of human, process, and resource factors in lean construction. By integrating these insights, this research contributes to a deeper understanding of the complexities of lean implementation and offers actionable strategies for improving its application in the construction industry.

Categorization of Themes

#	Theme	Category
1	The Importance of People and Culture	HC
2	Resistance and Adaptation	HC, P
3	Definition and Perception of Failure	HC
4	Measurement of Success and Continuous Improvement	P
5	Innovations and Approaches for First-Time Implementation	R, P

Table 6 Categorization of Interview Themes

The categorization of interview themes into Human-Centric (HC), Process (P), and Resource (R) categories provides a framework for understanding the various aspects of lean construction implementation. Human-Centric (HC) themes focus on behavioral, cultural, and social aspects that are crucial to lean success. For example, themes such as "The Importance of People and Culture," "Resistance and Adaptation," and "Definition and Perception of Failure" were categorized as HC because they emphasize the role of people, relationships, and leadership in lean construction. These themes highlight the

human elements that contribute to resistance, commitment, and buy-in, which according to the industry experts, are necessary to the successful adoption of lean practices.

Process (P) themes relate to the operational methods, continuous improvement practices, and tools used in lean construction. Themes such as "Measurement of Success and Continuous Improvement" and part of "Resistance and Adaptation" were categorized as P because they focus on metrics, processes, and approaches that guide lean implementation. Due to the alignment with the case study and interview experts, these themes illustrate how systematic evaluation and improvement practices are essential components of lean construction efforts.

Resource (R) themes address the effective allocation of tools, technologies, and other physical resources that support lean construction. The theme "Innovations and Approaches for First-Time Implementation" was categorized under both Resource and Process, as it involves leveraging technology and visual controls (Resource) as well as innovative practices and collaboration techniques (Process) to support lean implementation. By applying these categorizations, one can better understand the socio-technical balance required for successful lean construction and ensure that both human and technical components are addressed.

Interviews Summary

The interviews with four experienced lean construction professionals highlighted insights into the challenges and opportunities associated with implementing lean principles, particularly during first-time efforts. A recurring theme was the importance of

human-centric factors, emphasizing the need to foster a supportive learning culture, build trust, and develop problem-solving capabilities. Participants consistently noted that while tools and processes are important, successful lean implementation depends significantly on the engagement and alignment of individuals and teams. This focus on people aligns with the core lean principles of respect for people and continuous improvement, demonstrating that the human-centric element is necessary to achieving lean success.

Resistance was identified as a common barrier during the initial implementation of lean principles. Participants attributed resistance to factors such as unclear objectives, prior negative experiences, and the perception of lean as an added burden or threat to existing norms. Overcoming these challenges, they emphasized, requires clear communication, trust-building, and a focus on solving immediate pain points to demonstrate lean's value. Success also depends on ensuring alignment within teams by identifying shared problems and engaging stakeholders at all levels in the process. These strategies highlight the importance of starting with small, targeted efforts to build momentum and engagement.

The interviews further revealed diverse interpretations of success and failure in lean construction. Success was defined as incremental progress, meaningful "light bulb moments," and fostering a culture of continuous improvement. Failure, conversely, was described as disengagement, giving up on lean efforts, or rigidly applying tools without adapting them to the specific needs of the project. Measuring success effectively was highlighted as a key factor, with participants advocating for both qualitative and quantitative approaches, such as tracking team engagement metrics and observing

behavioral changes. This nuanced understanding underscores the need to approach lean implementation as a dynamic and iterative process rather than a one-size-fits-all solution.

Innovative strategies for first-time lean implementation also surfaced, focusing on leveraging technology, using visual tools for collaboration, and solving context-specific problems. Leadership played a crucial role in driving these efforts, with participants emphasizing the importance of visible commitment from leaders to model desired behaviors and support experimentation. By addressing both technical and cultural aspects of lean, these strategies provide a roadmap for overcoming challenges and embedding lean principles into construction practices.

These findings informed the design of the subsequent industry-wide survey, which aimed to capture broader perspectives on the challenges and opportunities associated with lean implementation. By examining the current state of lean adoption across the construction industry, the survey sought to validate and expand on the themes identified in the interviews. In doing so, it provides a comprehensive understanding of the factors that influence lean adoption and highlights the common barriers, perceptions, and definitions of success and failure within the field.

CHAPTER VI

SURVEY FINDINGS

Q1-Q5: Survey Population Responses

The industry-wide survey was sent out via email, researcher LinkedIn Post, Clemson Industry Advisory Board, Lean Construction Institute Corporate Member and Association of General Contractors Construction Management Lean credential graduate monthly newsletters and responded to by 116 people. Of the 116 survey participants, 114 were successfully classified into one of seven predefined categories. The available self-classification options for respondents were: (1) Intern or Project Engineer, (2) Assistant Project Manager (APM) or Project Manager, (3) Assistant Superintendent or Superintendent, (4) Lean Champion, (5) Project Executive, (6) Corporate Executive, and (7) Other. Two of the people responded with 'other' and did not add anything in the provided text entry. The researcher did assign 26 of the 'other' responses to the closest categorical survey response. That interpretation can be understood by referencing Table 5 below. The largest population by role was that of Assistant Project Manager or Project Managers (28%). It is noteworthy that 16% of the respondents identified themselves as Lean Champions within their respective projects or organizations. The distribution of this and other classifications can be examined in more detail by referencing the chart provided in Table 5.

Position from Survey	Self titled	To Fit Survey	New total	% of total population
Intern or Project Engineer	1		1	1%
APM or PM	25	8	33	28%
Asst. Supt. Or Supt.	18		18	16%
Lean Champion	14	4	18	16%
Project Executive	11	7	18	16%
Corporate Executive	19	7	26	22%
No response			2	2%
Other	28			
	116		116	
Other Title Distribution	Self Titled	To Fit survey		
1	Project Controls	APM or PM		
2	Director of Field Training	Project Executive		
3	Preconstruction Manager	APM or PM		
4	Retired PM - now trainer	APM or PM		
5	Senior Quality Manager	Project Executive		
6	Change Agent and Thought Leader	Corporate Executive		
7	Lean Coach Instructor	Lean Champion		
8	Director of Training and Development	Corporate Executive		
9	Lean Champion and VDC manager	Lean Champion		
10	PM	APM or PM		
11	Branch Manager	Corporate Executive		
12	Senior Estimator	Project Executive		
13	Preconstruction Director	Project Executive		
14	Owner	Project Executive		
15	Educator	APM or PM		
16	Manager of Business Development	Corporate Executive		
17	Training and Development Consultant and Professor	Corporate Executive		
18	Operations	Project Executive		
19	Estimator	APM or PM		
20	Director of Operations Technology	Corporate Executive		
21	Scheduler and Lean Champion	Lean Champion		
22	Senior Consultant	Corporate Executive		
23	Preconstruction Manager	APM or PM		
24	Estimator	APM or PM		
25	Field Ops Manager	Project Executive		
26	Lean Coach Instructor	Lean Champion		
27	Other	No Response		
28	Other	No Response		

Table 7 Researcher Assigned Titles to 'other' responses

The population of the survey also consisted of respondents who were experienced in the Construction Industry. Seventy-Nine (79%) of the survey respondents have been involved in the Construction Industry for 11 years or more. More than half of those respondents have been in the construction industry for over 21 years. See figure 4 below.

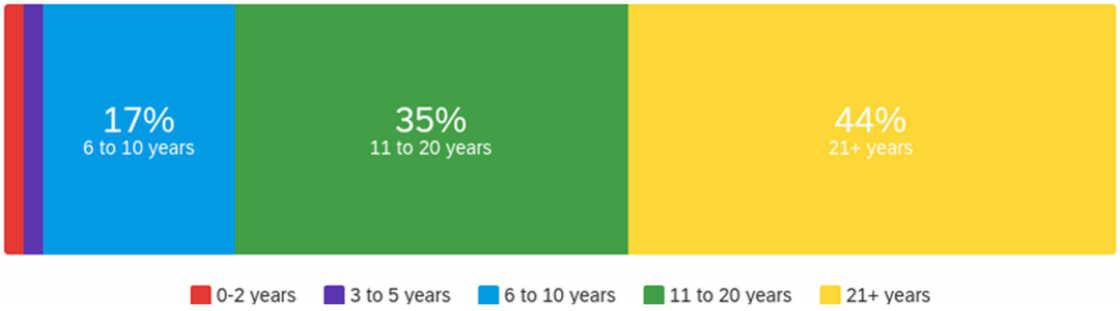

Figure 12 Survey Population breakdown by years of Construction Experience

Each respondent self-assessed their own lean maturity with regards to applying lean principles on construction project sites, the survey results show that fifty-eight (60%) of the respondents were either proficient (4 of 5) or experts (5 of 5) with applying lean principles on construction projects. See figure 14. However, the very next question was investigating how much training the respondents had and sixty-nine (69%) of the respondents indicated they had less than 1,000 hours of training with applying lean principles throughout their entire lifetime. See figure 13.

This is a direct conflict with the survey respondent's own definition of lean principles in question 8 below, which encourages continuous improvement via regular training. Less than 1,000 hours of training would not allow a person to be considered a lean construction expert, regardless of the self-assessment. According to Malcom Gladwell in the book, Outliers, a person could become an expert in any field if they were willing to spend 10,000 hours to study and practice the subject or skill. (Gladwell, 2019)

Figure 13 (above) Respondent's amount of training on lean construction

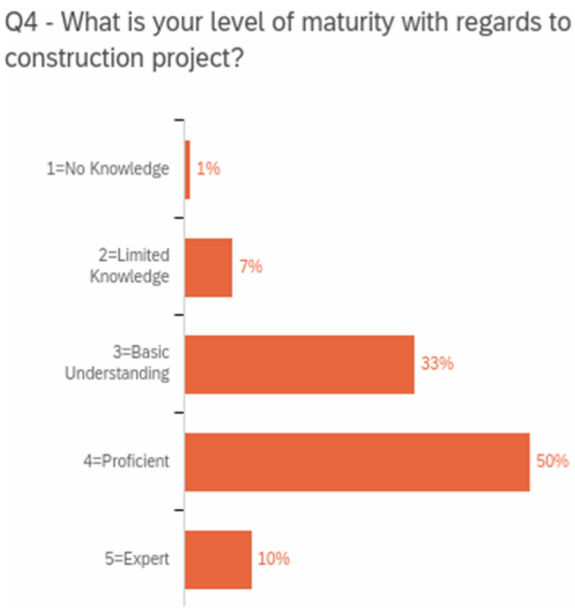

Figure 124 (above) Participants self-assessment of lean construction maturity

This discrepancy suggests a tendency for individuals in the construction industry to overestimate their expertise, which could stem from familiarity with the terminologies and tools of lean rather than a deep understanding of its principles.

The discrepancy observed in the survey data suggests a tendency for individuals in the construction industry to overestimate their expertise in lean construction, possibly due to familiarity with lean tools and terminology rather than a deep understanding of its principles. Specifically, 60% of respondents self-assessed as either proficient or expert in lean construction, yet 69% had less than 1,000 hours of training. This gap points to overconfidence despite limited practical experience, which aligns with the Dunning-Kruger effect, a psychological phenomenon where individuals with limited knowledge overestimate their competence (Kruger & Dunning, 1999). In this context, superficial familiarity with lean terms may create a false sense of expertise.

This self-proclaimed expertise undermines the essence of lean, which is centered around continuous improvement and lifelong learning. It is the researcher's belief that, in the practice of lean construction, one can never truly be an "expert." The philosophy of lean is one of perpetual growth and improvement, constantly seeking new efficiencies, better methods, and deeper collaboration. Therefore, the concept of mastery within lean is paradoxical, true adherence to lean means acknowledging that there is always room to improve, learn, and evolve. This perspective may help industry professionals shift away from self-proclaimed expertise and move toward a mindset that embraces humility and continuous learning as the cornerstones of lean implementation.

Further evidence from the case study and interviews supports this conclusion. Many participants highlighted issues such as resistance to change, misuse of lean tools, and the absence of foundational understanding of lean principles, all of which indicate a gap in true lean comprehension. Lean construction is not simply about the application of tools but requires a cultural shift and continuous learning, as emphasized by foundational texts such as "Lean Thinking" by Womack and Jones. True lean expertise is characterized by ongoing commitment and humility in learning, something that cannot be achieved solely through initial training or familiarity with lean practices.

The following questions represent the researcher’s discoveries with regards to the first research question: What are the factors contributing to the unsuccessful initial implementation of lean construction methodologies within construction projects?

Q6: Please identify how familiar you are with the following principles or tools: (this was a 5-point Likert scale where 1=Unaware, 2=Aware, 3=Understanding, 4=Competent, and 5=Mastery)

Figure 15 Respondent's familiarity with lean principles

This survey question aimed to evaluate participants' familiarity with specific lean principles, tools, and approaches commonly associated with construction. The results indicate that "Respect for People" is the principle respondents are most familiar with, achieving an average score of 4.59 on a 5-point scale. This finding emphasizes the value participants place on interpersonal dynamics and respect in lean implementation. However, as we delve further into subsequent questions, there is a noticeable gap between how "Respect for People" is understood conceptually and how it is practically integrated into construction projects.

Categorization of Themes

The categorization of these lean tools and principles was based on each underlying focus areas. Human-Centric (HC) principles, such as "Respect for People" and "Feedback," are centered on interpersonal relationships, trust-building, and effective communication, highlighting the critical importance of valuing individuals in lean implementation. Process (P) principles include tools like "Pull Planning," "Last Planner System," and "8 Wastes," which are aimed at establishing efficient workflows, minimizing waste, and continuously improving the construction process. The Resource (R) principle, "Define Value," emphasizes the optimization of resources to deliver value to clients. These categorizations offer a structured understanding of the distinct contributions of human, procedural, and resource-focused elements in lean construction, revealing the complexity of implementing lean principles effectively on construction projects.

Field	Mean	Category
Respect for People	4.59	HC
Pull Planning	3.96	P
Feedback	3.73	HC
Last Planner System	3.72	P
8 Wastes	3.71	P
Create Flow	3.62	P
Establish Pull	3.61	P
5S	3.57	P
Variation	3.46	P
Define Value	3.45	R
PDCA	3.34	P
Pursue Perfection	3.23	P
Map Value Stream	2.99	P
Takt Planning	2.94	P

Table 8 Participant's consolidated mean response and category.

Q7: Which lean principles or tools do you struggle with the most? Select all that apply.

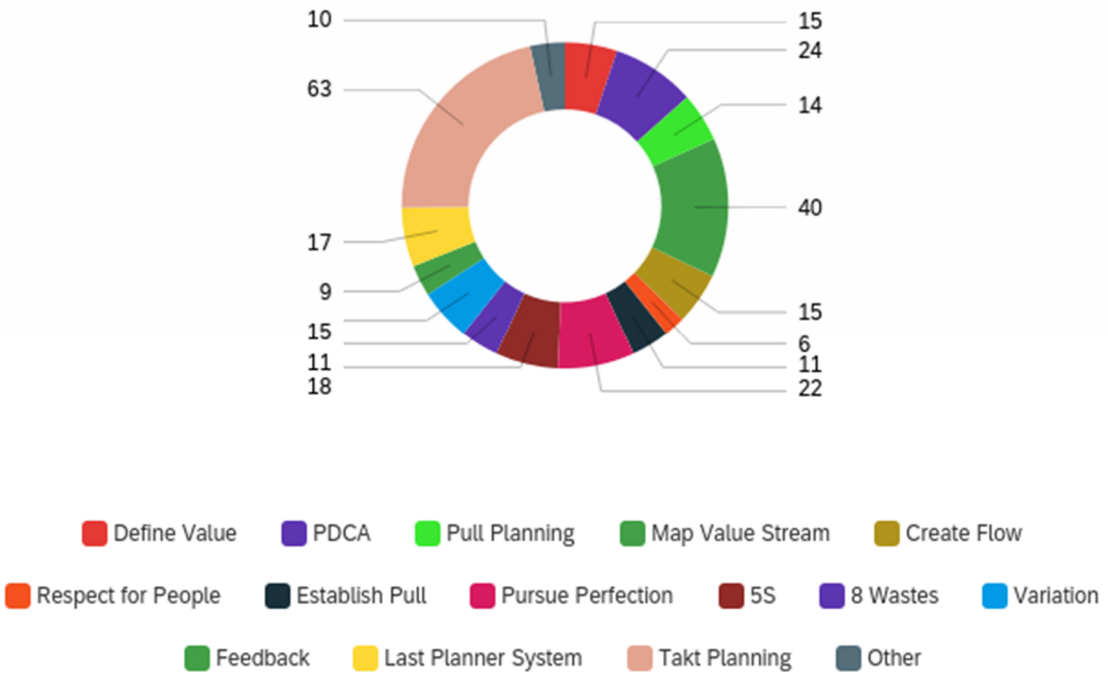

Figure 16 Respondent's response to lean principles or tools they struggle with most.

The findings from Question 7 provide a focused examination of the specific lean tools and principles that construction professionals find most challenging to implement. This survey aimed to identify these areas of difficulty, and the results reveal distinct patterns across the industry. Takt Planning emerged as the most frequently cited challenge, with 63 respondents indicating difficulties in applying this tool effectively. Despite its theoretical benefits for synchronizing operations and reducing waste, many professionals find it difficult to implement in real-world settings. Another notable challenge is Mapping Value Streams, cited by 40 respondents, reflecting the struggle in visualizing processes and optimizing them for value creation, a core component of lean construction.

Other tools that were frequently mentioned include PDCA (24 mentions), Pursue Perfection (22 mentions), and the Last Planner System (17 mentions). These findings suggest that while these tools are recognized as essential in lean construction, their practical application presents challenges for many professionals. Tools like Define Value, Pull Planning, Create Flow, and Variation were reported as moderately difficult, with mentions ranging from 14 to 15 respondents, indicating that while these principles are challenging, they may be more familiar or easier to apply in practice.

Interestingly, principles such as Respect for People and Feedback were identified by fewer respondents as challenges, with only 6 and 9 mentions respectively. This contrasts with other findings in case study and interviews that emphasize the importance of human-centric principles like respect for people in the success of lean implementation. The lower mention of these principles as challenges could suggest that professionals are either more comfortable with these relational aspects, that they are not as immediately recognized as critically associated with lean failures, or that participants do not fully understand these principles and what is required to make them work. However, this discrepancy points to the need for further exploration of the role of both technical and relational elements in lean construction, as the qualitative data from interviews suggests that building trust and communication are crucial but often overlooked factors.

Categorization of Themes

Human-Centric (HC) Factors: The categories of "Respect for People" and "Feedback" were assigned to the Human-Centric category as they focus on the

interpersonal and cultural dynamics essential for lean construction. Respect for People is about valuing individuals and their contributions, while Feedback emphasizes open communication and collaboration among team members, both of which are key elements of building a supportive work environment that is conducive to effective lean implementation.

Process (P) Factors: All other tools and principles, including Takt Planning, Mapping Value Streams, PDCA (Plan-Do-Check-Act), Pursue Perfection, Last Planner System, Pull Planning, Create Flow, and Variation, were categorized under Process. These principles are predominantly associated with streamlining workflows, optimizing production processes, and ensuring efficient project management. They are all instrumental in refining the way work is executed on a construction site, focusing on aspects like planning, scheduling, continuous improvement, and value generation.

Resource (R) Factors: "Define Value" was assigned to the Resource category, as it involves the strategic identification of value to be delivered, which directly impacts the allocation and use of resources. Value creation is a critical aspect of maximizing efficiency in lean construction, ensuring that resources are allocated effectively to meet project goals.

The categorization into these themes is consistent with the overall distinction of lean principles into those that deal with human relationships and behaviors (HC), those that target operational processes and workflows (P), and those that focus on the effective use of resources (R). The tools classified under Process are focused on enhancing efficiency and productivity through systematic management approaches, while the

Human-Centric elements target the cultural and relational side of lean construction that helps foster an environment where lean principles can flourish. The Resource element emphasizes the importance of identifying and maximizing value, which is key to the success of lean projects.

Lean Tool/Principle	Mentions	Category
Takt Planning	63	P
Mapping Value Streams	40	P
PDCA	24	P
Pursue Perfection	22	P
Last Planner System	17	P
Define Value	15	R
Pull Planning	15	P
Create Flow	14	P
Variation	14	P
Respect for People	6	HC
Feedback	9	HC

Table 9 Categorization of principles and tools respondents struggle with most

Q8: How would you define lean construction in your own words?

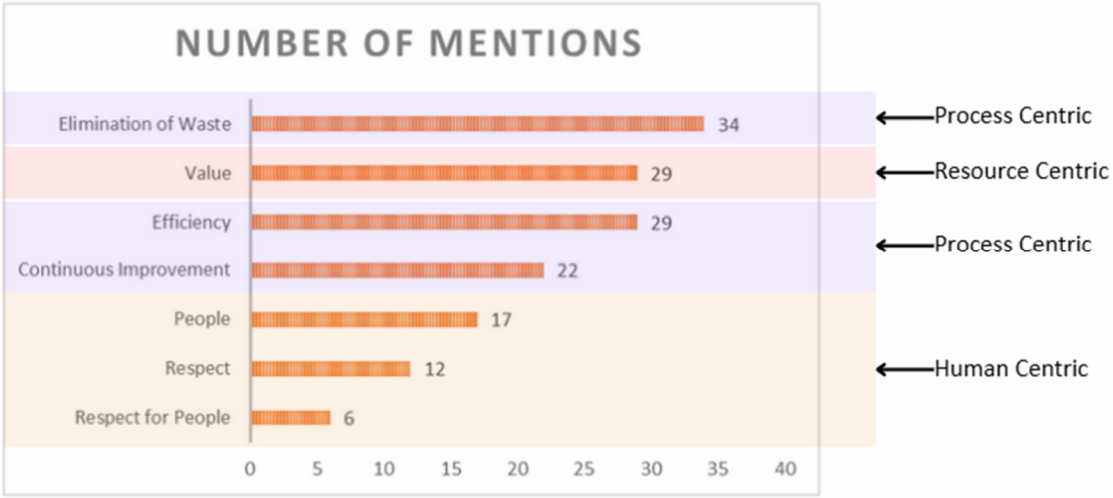

Figure 17 Respondent's mentions when defining lean construction categorized by Human-Centric, Process, and Resource.

This question was critical in helping the researcher understand how survey respondents defined lean construction. The survey responses revealed a contrast between the frequency of key terms used to define lean construction. The terms "Elimination of Waste," "Value," "Efficiency," and "Continuous Improvement" were mentioned in the survey at a rate of 3 to 1 compared to the human-centric terms "Respect for People," "Respect," and "People." This imbalance is particularly striking, as the number one theme in all the seasoned lean leader interviews was the importance of people and culture in the successful implementation of lean principles. The theme identified by the interviewees aligns directly with the Researcher's own case study experience.

Categorization of Themes

The data from Question 8 reveals various keywords that respondents used to define lean construction, which can be classified into Human-Centric (HC), Process (P),

and Resource (R) categories. Human-Centric factors, such as "Respect for People," "Respect," and "People," emphasize the importance of interpersonal relationships, values, and cultural considerations. These aspects are necessary for lean construction success, as they focus on the behaviors, interactions, and values of the individuals involved. The human elements highlighted in these responses reflect the influential roles of building trust, fostering respect, and encouraging participation, which are needed for the effective implementation of lean principles.

Process factors include "Continuous Improvement," "Efficiency," and "Elimination of Waste." These elements emphasize the methods, systems, and practices that are at the core of lean construction principles. "Continuous Improvement" signifies the commitment to ongoing evaluation and refinement of construction practices, while "Efficiency" and "Elimination of Waste" focus on optimizing workflow and minimizing unnecessary actions or resources. Meanwhile, the keyword "Value" is categorized as Resource, representing the desired outcome of managing resources effectively to achieve maximum client satisfaction. The categorization into Human-Centric, Process, and Resource highlights the importance of balancing human elements, effective processes, and resource management in defining and implementing lean construction.

The categorization of each item into Human-Centric (HC), Process (P), or Resource (R) was based on their underlying focus and contribution to lean construction implementation. "Respect for People," "Respect," and "People" were classified as Human-Centric, as they emphasize relationships, behaviors, and the importance of individuals within the construction process. "Continuous Improvement," "Efficiency,"

and "Elimination of Waste" were categorized as Process elements, as they reflect systematic efforts to enhance workflows, eliminate inefficiencies, and improve productivity. Lastly, "Value" was classified under Resources, as it concerns leveraging and optimizing available resources to maximize project outcomes and overall construction efficiency. This categorization provides a structured understanding of how different themes contribute to the success or failure of lean implementation from various perspectives.

The findings indicate that when organizations attempt to implement lean principles on construction projects, there is a prevailing focus on resource and procedural aspects, such as "Elimination of Waste," "Value Creation," and "Efficiency Gains." These are categorized as Process and Resource elements, reflecting the emphasis on optimizing workflows, resource allocation, and achieving measurable project outcomes. However, a notable oversight lies in the insufficient attention to Human-Centric (HC) factors, such as "Respect for People," "Collaboration," and "Building Human Capabilities." These human elements are fundamental to creating a culture of trust, engagement, and sustained commitment, which are necessary for the successful implementation of lean principles.

The lack of focus on the human side of lean has emerged as a contributor to the failure of initial lean implementation, as evidenced by the triangulation of the survey data, interviews, and case study findings. This study reinforces the importance of aligning lean implementation strategies with the underlying human aspects, recognizing that without fostering a culture of respect, buy-in, and collaboration, even the best process or resource solutions are will falter. Addressing the human, process, and resource

dimensions of lean is essential for creating a balanced, sustainable approach to applying lean principles to construction projects.

Q9: How well does your organization do the following items: (1=Terrible, 2=Not good, 3=Ok, 4=Good, and 5=Great)

Field	Mean
Keep a clean and organized project site	3.69
Empower everyone to speak up	3.57
Establish work flow on projects (the way work will be completed in a specific area of the job site)	3.42
Establish logistical flow on projects (the way equipment and materials move around the jobsite)	3.34
Engage the trade workers minds	3.32
Establish trade flow on projects (the way trades will flow through the work on a jobsite)	3.25
Improve from day to day	3.2
Pause and reflect to make adjustments to operations	3.15
Have a process easily identified for the trade worker to understand	3.13
Establish clear production goals visually	3.09

Table 10 Respondents rank their organizations on lean concept performance

The findings from question 9 of the survey provide insights into how organizations are applying lean principles within construction projects. The data shows that "Keeping a clean and organized project site" received the highest mean score (3.69), reflecting a moderate level of agreement among respondents. This suggests that maintaining site cleanliness and organization, which are elements of lean construction methodologies, is a focus for many organizations. However, other principles, such as "Establish clear production goals visually" (mean = 3.09) and "Have a process easily identified for the trade worker to understand" (mean = 3.13), received lower but comparable mean scores. These results highlight opportunities for improvement in areas related to communication and process transparency—important aspects for optimizing workflow efficiency and coordination on project sites. While the differences between the

scores are not substantial, they suggest that organizations may be placing relatively more emphasis on physical organization than on visual communication and process clarity.

The survey results for "Empower everyone to speak up" (mean = 3.57) and "Engage the trade workers' minds" (mean = 3.32) indicate a neutral level of agreement, suggesting room for improvement in fostering a more inclusive and participatory culture. While the data shows some effort to engage and empower workers, it also implies that organizations may not yet be fully leveraging the intellectual contributions of the workforce. This is critical for advancing continuous improvement and problem-solving—core tenets of lean construction.

In comparing the findings from question 9 to those of question 7, an interesting disparity emerges. While individuals perceive lean tools such as Respect for People and Feedback as less challenging on a personal level, the data from question 9 suggests organizations face more challenges in implementing processes that directly influence worker engagement and communication. This indicates a potential misalignment between individual perceptions and organizational practices, particularly in areas that rely on active workforce participation.

The mean scores for "Establish clear production goals visually" (3.09) and "Have a process easily identified for the trade worker to understand" (3.13) are among the lowest in the survey, yet they remain close to the average for all items, reflecting a consistent but neutral level of application across principles. Rather than highlighting stark differences, these results point to a need for improvement across all aspects of

communication and process transparency, with an emphasis on fostering clearer production goals and simpler processes for trade workers.

Overall, the close range of scores across all items suggests that organizations have relatively consistent practices in applying lean principles but still have opportunities for growth. The neutral responses across the board underscore the importance of focusing on all ten items holistically to strengthen worker engagement, enhance communication clarity, and promote reflective practices. This balanced approach can help ensure lean principles are implemented comprehensively and effectively.

Q10: Have you been involved with a construction project that attempted to implement lean principles?

The results from question 10 reveal that 84% of respondents (97 out of 116) have been involved in a construction project that attempted to implement lean principles, while 15 respondents indicated they had not, and 4 selected "Other." This high level of exposure to lean construction projects suggests that the survey participants possess practical experience with lean principles, which lends credibility and depth to the insights gathered throughout the survey. The logic embedded in the question ensured that those who had not participated in lean projects skipped to question 15 in the survey, allowing the analysis to focus on respondents with relevant experience. These results provide a robust foundation for the subsequent findings, ensuring that the feedback and observations are drawn from those with firsthand knowledge of lean construction practices.

Q11: How successful do you believe the initial implementation of lean principles on your construction project was? (1=Not successful at all, 2=A little success, 3=Neutral, 4= Successful but room for improvement and 5=Highest degree of success)

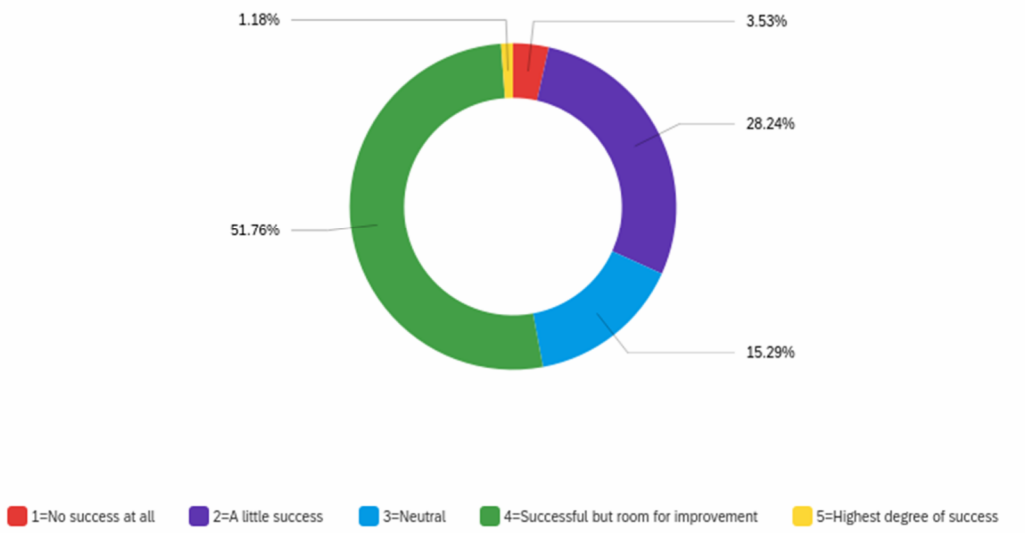

Figure 138 Respondents determine the level of success on their initial implementation of lean principles on a construction project

The data collected for Question 11, yielded an average rating of 3.19. This indicates a moderate level of success, with 81 of the 85 respondents on this question, reporting a middle-ground level of success (between 2 and 4 response) in applying lean principles during their initial implementation.

These results were surprising and could reflect a superficial or incomplete understanding of the true depth of lean principles, focusing more on process and efficiency rather than the human factors emphasized in the other research methods used in this study. The conclusion that the results may reflect a superficial or incomplete

understanding of lean principles is supported by the recurring themes and findings in both the interviews and case studies explored in this research. Both methodologies consistently emphasized the role of human factors such as: trust, engagement, respect for people, and cultural integration as necessary to the successful implementation of lean principles. The moderate success rating of 3.19 in the survey suggests that these human-centric elements may not have been fully prioritized during initial implementations, potentially indicating that organizations have focused more on tools and processes as drivers of lean adoption. However, it is important to note that the survey data alone does not provide conclusive evidence for this hypothesis. Additional questions or analysis would be necessary to establish whether this focus on tools and processes over human-centered elements contributed to the neutral responses observed.

The challenges of resistance and misapplication, as highlighted in the survey results, further reinforce the conclusion that human-centric elements may not be fully prioritized in lean construction implementation. The moderate success rating of 3.19 in the survey suggests a potential tendency to focus on tools and processes over deeper cultural and human dimensions, which are critical for successful lean adoption. Resistance often stemmed from a rigid application of lean principles and a failure to adapt them to the unique context of each project. This misapplication points to a lack of understanding of the underlying cultural and relational aspects of lean construction, resulting in a more superficial emphasis on procedural efficiency rather than fostering inclusive, adaptive, and collaborative practices. However, additional analysis would be

required to confirm whether the observed neutral responses are directly tied to this focus on tools and processes.

Additionally, survey results revealed gaps in communication, worker engagement, and reflective practices, further pointing to a narrow interpretation of lean principles. While some progress may have been achieved in technical areas, these deficiencies could suggest that the broader, holistic vision of lean which encompasses both human-centric and process improvements was not fully realized.

The insights from interview participants also corroborate this perspective. Across the discussions, participants stressed the importance of embedding lean principles into a supportive cultural framework rather than simply treating them as a set of tools or techniques. The moderate success ratings observed in the survey likely reflect this disconnect between lean's potential as a holistic approach and its practical implementation.

While the overall success rate of initial implementation of lean principles on a construction project appears moderate (mean = 3.19), the distribution of responses which ranged between 2 and 4 for 81 of the 85 respondents, suggests variability in how organizations approach lean adoption. This range highlights that while some organizations may achieve reasonable success, others are likely falling short in key areas. The moderate success and variability point to the need for tailored strategies, as the data indicates that a one-size-fits-all approach does not adequately address the diverse challenges and contexts faced by project teams.

These findings align with earlier observations in the case study and interviews, where challenges around leadership, worker engagement, and process optimization emerged as critical factors influencing lean outcomes. For instance, lower scores in related survey items, such as “Engage the trade workers’ minds” (mean = 3.32) and “Establish clear production goals visually” (mean = 3.09), reflect underlying gaps in communication and empowerment, both necessary to lean success. The variation in success ratings, when considered alongside these related challenges, underscores the necessity for a more nuanced and context-specific application of lean principles to bridge these gaps effectively.

Q12: What makes initial implementation of lean principles on a construction project succeed?

Theme	Mentions	Category
Buy-in	22	HC
Leadership	18	HC
Training	15	P
Collaboration	13	HC
Trust	13	HC
Technical Execution	6	R

Table 11 Summary of Respondent's mentions on what makes initial implementation of lean principles succeed

The analysis of 85 responses to question 12 identified five major themes as critical to the successful implementation of lean principles in construction projects: buy-in, leadership, training, collaboration, and trust. Among these, buy-in emerged as the most referenced factor, with 22 mentions, accounting for 26% of the total mentions

across all themes. This highlights its significant role in fostering alignment and commitment among stakeholders. Leadership followed with 18 mentions (21% of total mentions), emphasizing the importance of a strong leader or lean champion to guide the team and maintain accountability. Training was referenced 15 times (18% of total mentions), underscoring its critical role in equipping teams with the knowledge and skills necessary for lean implementation. Collaboration and trust were mentioned 13 times each, collectively representing 31% of total mentions when combined, due to the close interrelationship between these factors in fostering effective communication and rapport.

When categorizing these themes into human-centric (buy-in, leadership, collaboration, and trust) versus less human-centered factors (training and technical execution), the data shows that human-centric themes were mentioned 66 times (78%) compared to 19 mentions (22%) for less human-centered themes. This reinforces the critical importance of human behavior and group dynamics in driving lean success. Furthermore, buy-in was mentioned 35% more frequently than training, and leadership was 20% higher than training, indicating the relative weight of these factors. These comparative differences suggest that while training is essential, human-centric elements such as stakeholder alignment, strong leadership, and fostering collaboration and trust are even more critical for achieving successful outcomes.

The overlap between collaboration and trust underscores the interconnected nature of these human factors. Comments about collaboration often referenced trust as a foundational element, particularly in building transparency and rapport among stakeholders. Given this close relationship, consolidating these into a single category

results in a total of 26 mentions, surpassing all other factors. This reaffirms that fostering cooperative, trust-based relationships is pivotal to lean implementation success.

Overall, the data suggests that organizations aiming for successful lean adoption should prioritize a holistic approach that combines technical tools with a strong emphasis on human-centric factors. Building a culture of collaboration, trust, and leadership, while ensuring comprehensive training, creates an environment where stakeholders are aligned and empowered to achieve shared goals. With buy-in from leadership, trade partners, and project teams, organizations are better positioned to overcome resistance, apply lean principles effectively, and achieve sustainable improvement.

Q13: What makes initial implementation of lean principles on a construction project fail?

Theme	Number of Mentions	Category
Lack of Buy-in	22	HC
Leadership/Commitment Issues	18	HC
Misuse or Lack of Understanding	15	P
Resistance to Change	13	HC
Communication and Clarity Issues	10	P

Table 12 Summary of Respondent's mentions on what makes initial implementation of lean principles fail categorized by human centric (HC), process centric (P), or resource centric (R).

As noted in question 11, 98% of respondents indicated that there was room for improvement when attempting to implement lean principles for the first time on their construction project. This open-ended question was designed to understand deeper what

respondent's feel the barriers to initial implementation of lean principles on a construction project are.

The structural and process-related challenges are as much a part of this complex web as any other factor. A systemic lack of trust weaves its way through teams, bringing with it a hesitance to embrace new methodologies and a misalignment of goals and actions. Organizational inertia prevails, marked by a reluctance to deviate from the previously established path. The following are themes that were derived from the responses to this open-ended question on the survey:

Lack of Buy-in and Commitment:

A significant theme emerging from the survey responses, with 22 mentions, is the lack of buy-in and commitment from various stakeholders, particularly upper management, superintendents, and trade partners. Respondents indicated that without full support from these leadership (18 mentions) and key players, lean implementation efforts are often undermined. This lack of commitment was further compounded by a lack of understanding and engagement with lean principles (15 mentions), leading to a superficial adoption of lean tools without a deep-seated cultural change.

The researcher would argue that the lack of buy in stems from a lack of interest in the people who are doing the work. This was made evident in the case study and with the researcher's own maturation with the human side of lean construction. When supervisors and managers are intentional about showing extreme attention and respect to the people doing the work and/or other supervisors, the buy-in comes as a natural result of the trust

that is developed. This has been the key to the researcher's success with implementing lean construction on projects.

As the survey results to this question show, the core of these impediments is an evident deficiency in buy-in and commitment, especially from the upper echelons of leadership, creating hesitance and resistance across the board. This pause extends to a broader organizational sphere, where a collective willingness to fully embrace lean practices remains elusive. The stakeholders, including those wielding tools and making daily decisions on the ground, often lack the necessary drive to propel lean initiatives forward, with trade partners particularly unmotivated in the absence of tangible incentives. (Hamza Kahn, 2024)

Resistance to Change and Old Norms:

Eighty-three (83%) of survey respondents highlighted resistance to change as a major barrier to successful lean implementation. This resistance often stems from a deep-rooted adherence to traditional construction practices and a reluctance to deviate from known methods. (Akugizibwe, 2014) This statement triangulates perfectly with the case study, the interviews, and the survey.

As mentioned by Participant # 2, the fear of change, coupled with skepticism and a "me first" mindset, creates an environment where new lean methodologies struggle to gain traction. The mention of "energy vampires" by Interview Participant #4, serves as a shocking metaphor for individuals who siphon off the vital momentum needed to sustain a lean transition.

Cultural and behavioral inertia from generations of builders before, further cement these difficulties. (Emiliani, 2018) An attachment to traditional management styles and a propensity to revert to familiar practices in times of stress or change act as an undercurrent resisting progress (Emiliani, 2018) This was a significant issue as noted in the Researcher's case study.

Communication and Clarity Issues:

Another prevalent theme is the lack of clear communication and clarity regarding lean principles and their expected outcomes. 10 responses pointed to unclear expectations, poor understanding of lean's value, and insufficient communication about lean's objectives as reasons for implementation failure. The 10 responses also noted that late introduction of lean tools and practices in the project lifecycle further exacerbates these clarity issues, making it difficult for teams to adapt and see the benefits of lean methodologies. Communication or rather, the lack thereof, stands out as an obstacle that was identified with the triangulated method of this research. A shortfall in effective dialogue has led to blurred expectations and misunderstandings about the very essence of lean principles.

Misuse and Misunderstanding of Lean Tools:

A theme related to the misapplication and misunderstanding of lean tools and principles emerged from 15 survey responses. Participants indicated, by these mentions, that treating lean as merely a set of tools or a production improvement program, without grasping its underlying philosophy, leads to superficial implementations that fail to

deliver meaningful change. Additionally, the misuse of lean systems as a means of control or as a "weapon" against team members was noted by 10 responses as a counterproductive approach that breeds distrust and disengagement. Again making it difficult to find the root cause as each of these causes reinforce one another.

This phenomenon was observed across all three triangulated approaches to this research: the case study, interviews, and survey. Borrowing from Davie Thomson's concept of "Bullshido," the researcher adapts the term to critique the superficial and fragmented practices in lean construction implementation (Thomson, 2021). The term "Bullshido" itself is a satirical adaptation of the Japanese concept of Bushido, which means the ethical code of the samurai, used here to highlight the contrast between genuine adherence to principles and surface-level practices. Thomson's critique of "Belt Bullshido" in Lean Six Sigma exposes the dangers of prioritizing symbolic achievements, like belt certifications, tools, or processes, over the deeper principles of mindset, discipline, and genuine improvement.

In the context of lean construction, "Lean Construction Bullshido" describes the fragmented and inconsistent application of lean principles, where tools and methods are deployed without a cohesive understanding of the underlying philosophy. Just as Thomson critiques the focus on superficial metrics in Lean Six Sigma, this term draws attention to the misalignment between lean tools and their intended purpose, which undermines the transformative potential of lean construction practices.

The researcher's experience in the case study vividly reflects this dynamic. Initial enthusiasm for lean principles often faltered as missteps in implementation and a focus

on short-term results overshadowed the persistence and cultural integration required for success. Survey respondents and interview participants echoed these observations, highlighting the importance of leadership, communication, and trust in overcoming resistance to change and ensuring sustained lean adoption. "Lean Construction Bullshido" serves as a cautionary metaphor for what happens when lean is applied superficially or divisively, emphasizing the need for an integrated approach that aligns human, process, and resource factors to achieve meaningful outcomes.

When comparing the results of Question 12 and Question 13, a notable observation emerges: while collaboration is a dominant factor in what makes lean implementation succeed, resistance to change occupies a similar position as a barrier to its success. This contrast highlights the duality of human and organizational behavior in lean adoption. On one hand, effective collaboration fosters alignment, trust, and shared purpose, creating an environment conducive to lean implementation. On the other hand, resistance to change undermines these efforts, often stemming from the same human dynamics that enable collaboration, such as interpersonal relationships, established norms, and organizational culture.

The overlap between collaboration and resistance to change underscores the complexity of lean adoption. It suggests that the presence of collaboration acts as a counterbalance to resistance, where fostering strong relationships and open communication can mitigate the hesitance and skepticism associated with new methodologies. If the themes of collaboration and resistance to change were consolidated, they would collectively represent a central factor in lean success or failure, emphasizing

the need to focus on cultural transformation and human engagement as critical components of lean implementation.

This interrelation between collaboration and resistance also demonstrates how human-centric themes dominate the conversation surrounding lean adoption. Combining the human-related themes from both questions such as: buy-in, leadership, collaboration, and trust on the success side, and lack of buy-in, resistance to change, and leadership issues on the failure side shows that 55% of responses across both questions center on human factors. This overwhelming emphasis on human dynamics reinforces the argument that addressing these themes is paramount to overcoming barriers and ensuring the long-term success of lean principles in construction projects.

Categorization of Themes

The data from Question 13 reveals several distinct themes that contribute to the initial failure of lean construction implementation, which have been categorized into Human-Centric (HC), Process (P), and Resource (R) elements. The Human-Centric (HC) factors focus on behaviors, relationships, and leadership dynamics that are essential for lean construction success. These elements encompass interpersonal aspects, such as team cohesion, motivation, and stakeholder engagement. On the other hand, process (P) factors relate to the practices, methods, and tools that structure how work is managed, facilitated, and improved. They emphasize efficient workflows, clarity, and accountability in lean implementation. Lastly, Resource (R) factors involve leveraging specific resources or opportunities to optimize construction efficiency. Together, these categorizations help to

provide a structured understanding of how human behaviors, systematic processes, and resources contribute to lean implementation success or failure.

The most mentioned theme, "Lack of Buy-in," which appeared in 22 responses, was categorized as Human-Centric (HC). It highlights the importance of collective engagement, motivation, and stakeholder participation in lean initiatives. Without buy-in from the leadership, superintendents, trade partners, and other stakeholders, lean efforts often falter. Similarly, "Leadership/Commitment Issues," mentioned 18 times, also falls under the Human-Centric category as it encompasses the importance of supportive and engaged leadership in guiding lean practices. Effective leadership is crucial for fostering a culture that embraces lean principles, and without a committed leadership team, the adoption process often remains superficial or incomplete.

"Misuse or Lack of Understanding," which received 15 mentions, was classified as a Process (P) issue. It refers to challenges related to understanding or applying lean tools and methodologies appropriately. When lean is misunderstood or used incorrectly, it can lead to superficial adoption rather than meaningful cultural change. "Communication and Clarity Issues," with 10 mentions, is also categorized under Process (P). This theme points to difficulties in communicating lean principles, expected outcomes, and their value to the project. Ineffective communication can hinder proper implementation, as team members struggle to understand the overall objectives and goals.

"Resistance to Change," which appeared in 13 responses, is another Human-Centric (HC) theme that highlights the reluctance of individuals to adopt new lean methodologies. Resistance to change often stems from an attachment to traditional

practices, fear of the unknown, or skepticism towards new approaches. Such resistance can be a major barrier to lean adoption and reflects the need for stronger efforts to shift organizational culture and foster openness to change.

By categorizing the themes from Question 13 in this way, it becomes clear that the barriers to lean construction implementation are heavily influenced by both human-centric and process-related factors. Addressing these challenges requires not only improving process clarity and application but also fostering trust, commitment, and buy-in among all team members involved in the construction project. This understanding provides a foundation for developing targeted strategies to mitigate the barriers to lean adoption and ensures a balanced focus on both human and procedural elements as the research progresses to the next phase.

Q14 – Did the project team engage the trade partners effectively on the first implementation of lean principles on your construction project? (1=Not at all, 2=A little bit, 3= Neutral, 4=Sometimes, and 5=All the time)

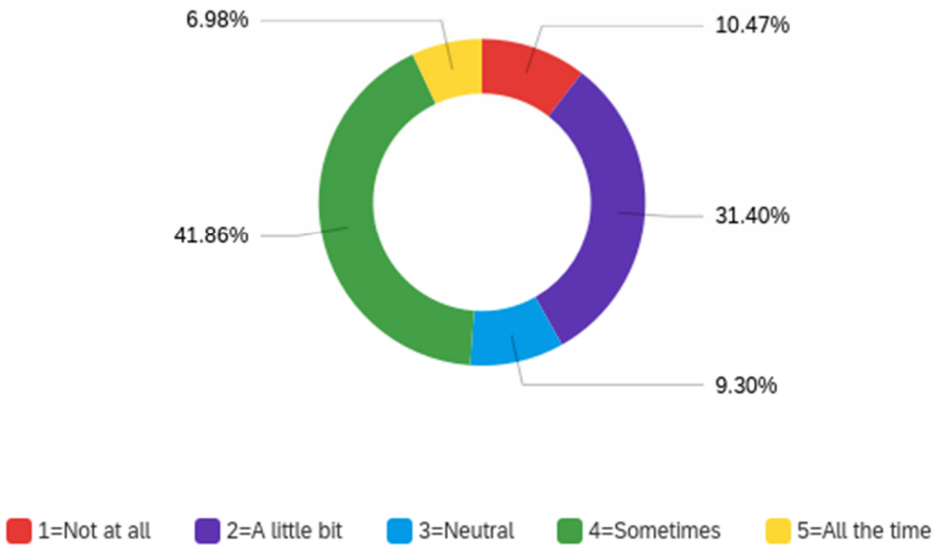

Figure 19 Respondents on engaging trade partners with lean principles effectively

The responses to Question 14 reveal a range of experiences regarding trade partner engagement during the first implementation of lean principles, with most responses clustering around the middle of the scale. While 7% of the 66 respondents rated their engagement experience as a 5, indicating strong integration of trade partners, 10% rated it as a 1, highlighting instances of minimal or no engagement. The average response appears to be slightly above 3, suggesting a neutral to moderate level of success across the projects surveyed. These results indicate variability in how effectively trade

partners were involved, which may reflect broader differences in organizational practices, leadership approaches, and team dynamics rather than an outlier pattern.

While these findings do not strongly indicate widespread failure or success, they do agree with the case study and interview that engagement of all stakeholders is important to drive total team buy-in and schedule creation in the most realistic ways possible. Specifically, securing full trade partner engagement may depend on addressing factors such as clear communication, leadership, and accountability. Interviews with participants emphasized that trust, open dialogue, and shared expectations are essential for aligning trade partners with lean goals. Similarly, case study findings suggest that when leaders fail to prioritize consistent communication and establish accountability structures, trade partners are less likely to feel included or invested in the process.

The variability in responses underscores the opportunity to improve the ability to integrate trade partners into lean initiatives. Future efforts should aim to improve alignment through intentional strategies that prioritize collaborative leadership, transparent expectations, and regular feedback loops. While the data does not provide a definitive assessment of trade partner engagement, it highlights an area where consistency and improvement are likely necessary to fully realize the potential of lean principles in construction projects.

Q15 – Please rate the following statements, indicating your perception of barriers to initial implementation of lean principles on construction projects within your company.

Barrier	Mean Score	% of Respondents Agreeing	Category
Resistance to change among project personnel	4.22	84.38% (41.67% somewhat agreed, 42.71% strongly agreed)	Human-Centric (HC)
Lack of understanding of lean principles	4.13	81.25%	Human-Centric (HC)
Insufficient training and education	4.06	79.17%	Human-Centric (HC)
Inadequate communication and collaboration	3.79	72.92%	Process (P)
Budget constraints	3.45	65.63%	Resource (R)
Schedule pressures	3.36	64.58%	Resource (R)

Table 13 Barriers to Initial Implementation of Lean Principles categorized by HC, P, and R

Categorization of Themes

The results of Question 15 highlight key barriers hindering the successful initial implementation of lean principles in construction projects, which can be categorized into Human-Centric (HC), Process (P), and Resource (R) factors. The highest-ranked barriers fall under the Human-Centric category, emphasizing that resistance to change (mean 4.22), lack of understanding of lean principles (mean 4.13), and insufficient training and education (mean 4.06) are significant obstacles. These findings underscore the importance of addressing behavioral and cultural dynamics that influence how individuals and teams engage with lean principles.

Process (P) factors, such as "Inadequate communication and collaboration among project teams" (mean 3.79), also emerge as critical barriers. Effective implementation of lean requires clear communication pathways and collaborative frameworks to align teams around shared objectives. These findings connect to Question 14, which highlighted variability in trade partner engagement, suggesting that communication challenges extend beyond internal teams to external stakeholders. Case study findings further corroborate

these insights, demonstrating how breakdowns in communication and collaboration can derail lean initiatives.

Resource (R) factors, such as budget constraints (mean 3.45) and schedule pressures (mean 3.36), scored lower than human-centric and process-related issues but remain relevant considerations. These factors often exacerbate challenges in training, communication, and stakeholder alignment by limiting the time and resources available for comprehensive lean implementation efforts.

The term "cultural factors" in this analysis refers to the Human-Centric barriers such as resistance to change, communication breakdowns, and leadership challenges. These elements define the organizational culture, influencing whether teams are open to new methodologies like lean principles. Survey responses on resistance to change align closely with interview findings, where participants repeatedly emphasized the importance of fostering a collaborative and trusting culture to overcome inertia and promote buy-in.

The categorization of barriers into Human-Centric (HC), Process (P), and Resource (R) was applied to provide a structured framework for analyzing the diverse challenges identified in the survey. Human-Centric (HC) factors encompass behavioral, cultural, and leadership-related issues, such as resistance to change, lack of understanding, and insufficient training, which directly influence how individuals and teams engage with lean principles. Process (P) factors address the operational aspects of lean implementation, including inadequate communication and collaboration, which are critical for aligning teams and ensuring effective workflows. Resource (R) factors pertain to tangible constraints, such as budget limitations and schedule pressures, which can

restrict the time, funding, and tools necessary for successful implementation. This categorization enables a comprehensive understanding of how various barriers interrelate and emphasizes that successful lean implementation requires addressing not only the human and cultural dimensions but also the procedural and resource-related elements that underpin project success.

The conclusion, that addressing human and cultural elements is critical for successful lean implementation, draws from the survey findings and their alignment with other research steps. Resistance to change (HC), as the top barrier, highlights the need for cultural transformation. Similarly, the high rankings for lack of understanding (HC) and insufficient training (HC) emphasize the importance of education and trust-building. Process-related barriers (P), such as inadequate communication, further illustrate how aligning teams through effective dialogue is essential for success. Resource-related barriers (R) like budget and schedule constraints add a layer of complexity, underscoring the need for a balanced approach that integrates human, process, and resource factors. Collectively, these insights reinforce the argument that a holistic focus on cultural, educational, and procedural dynamics is essential for fostering sustainable lean implementation.

The next portion of the result findings represents the Researcher’s discoveries with regards to the second research question: How do initial failures in lean construction implementation shape the broader industry's perception of applying lean principles on construction projects?

Q16: Rate your agreement with this statement: The construction industry has a clear understanding of what using lean principles on a construction site entails.

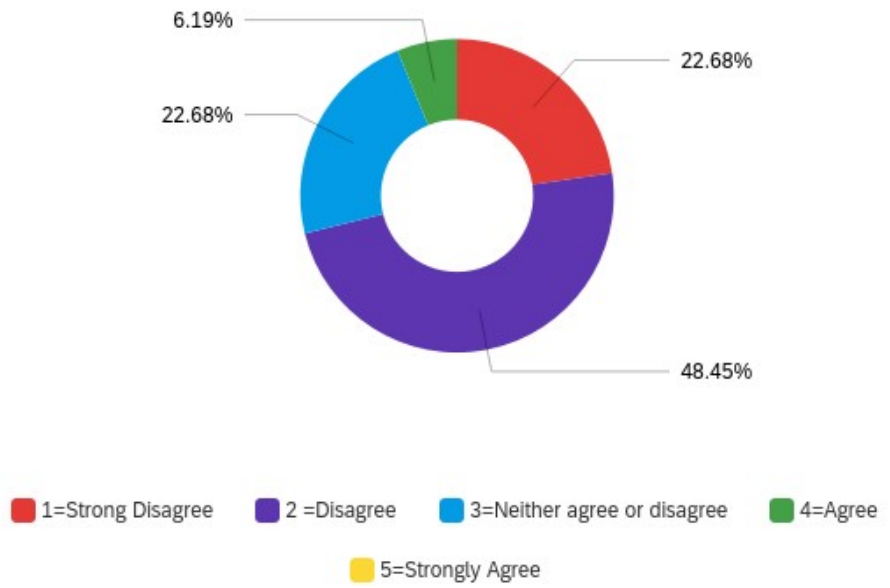

Figure 140 Rate your Agreement with this statement: The construction industry has a clear understanding of what using lean principles on a construction site entails

The data from Question 16 (See Figure 18) responses reveals a significant lack of confidence in this statement, with over seventy-one percent (71%) of respondents either disagreeing or strongly disagreeing that the construction industry has a clear understanding of what using lean principles on a construction site entails. Specifically, 48.45% disagreed, and 22.68% strongly disagreed, indicating that most respondents believe the construction industry lacks a solid understanding of how to effectively apply lean principles on a construction site. This finding aligns with the earlier results regarding the respondents' own definitions of lean construction, further emphasizing the industry's overall uncertainty and inconsistency in grasping lean principles.

Additionally, the data shows that no respondents strongly agreed with the statement, while only 6.19% agreed, further illustrating the widespread perception of confusion or misunderstanding within the industry regarding lean construction. Another notable finding is that 22.68% of respondents neither agreed nor disagreed, reflecting a level of uncertainty among professionals. This highlights an important gap in both education and communication within the industry, as practitioners may feel they lack sufficient knowledge to take a definitive stance on lean principles. These insights further underscore the need for improved training and a more cohesive industry-wide approach to implementing lean practices.

Q17 – In your opinion, how effective is the Construction Industry currently in implementing lean principles on construction projects?

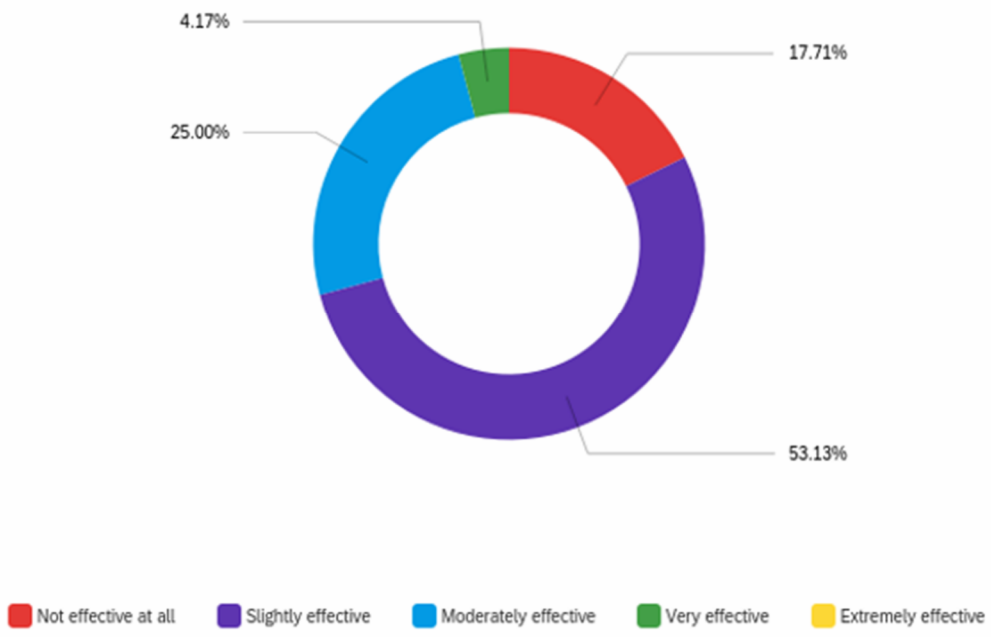

Figure 21 How effective is the construction industry at implementing lean principles on construction projects?

The data from Question 17 asked respondents to evaluate how effective they believe the construction industry currently is at implementing lean principles on construction projects. The results reveal that 53.13% of respondents rated the industry's efforts as "slightly effective," while 17.71% stated that the industry is "not effective at all." In contrast, only 25% of respondents indicated that the industry is "moderately effective," with a small minority of 4.17% stating that the industry is "very effective." Notably, no respondents rated the industry's efforts as "extremely effective." These findings underscore a widespread perception among industry professionals that there is substantial room for improvement in the application of lean principles.

While the low perception of effectiveness highlights significant challenges, it is important to note that the data does not establish a direct correlation between a lack of lean understanding and the failure of lean initiatives. Although many respondents and previous questions suggest that lean understanding is low across the industry, this alone cannot be definitively identified as the primary source of failure. Instead, the survey findings and broader research indicate that lean implementation is vulnerable to multiple failure modes, including but not limited to understanding levels. For example, case study and interview findings consistently highlight barriers such as resistance to change, communication breakdowns, process misalignment, and insufficient leadership engagement, which were more frequently cited as causes of failure. While a lack of lean understanding may exacerbate these issues, the evidence suggests that addressing other critical factors, such as fostering buy-in, improving collaboration, and aligning processes with project goals, is equally essential for overcoming the challenges of lean implementation.

These results suggest that the construction industry operates within a complex system where multiple, overlapping failure modes can obscure the potential benefits of lean implementation. Teams new to lean may abandon the approach prematurely if they fail to see immediate improvements in project performance, even if lean principles are generating other, less tangible benefits. This aligns with earlier reflections on the importance of fostering a culture of persistence and emphasizing long-term gains rather than short-term results during the initial stages of lean adoption. Furthermore, the lack of perceived effectiveness may reflect a broader need to improve human-focused strategies,

education, and leadership across the industry, ensuring that teams are better equipped to navigate these challenges and realize the full potential of lean practices.

Q18 – Select the definition of failure that comes to you after hearing this statement, "failure to implement lean principles on a construction project for the first attempt."

The data from Question 18 reveals that the most significant definition of failure, as identified by respondents, is the lack of buy-in from key stakeholders, including trade partners, general contractors, architects, owners, and vendors. With 44.79% of respondents highlighting this issue, it becomes clear that successful lean adoption depends heavily on the collective engagement of all parties involved in the project. Without a unified commitment, lean initiatives are likely to fail as teams struggle to align their efforts towards common lean objectives. The importance of stakeholder buy-in was consistently underscored throughout the survey, case study, and interviews, demonstrating its central role in the success and failure of lean construction initiatives.

In addition to buy-in challenges, 21.88% of respondents reported that giving up on lean principles was a significant reason for failure. This indicates that while projects may initially commit to implementing lean practices, maintaining that commitment proves challenging. Factors contributing to this abandonment include a lack of understanding of lean methodologies, difficulties in practical application, and an absence of immediate results. Additionally, 18.75% of respondents noted resistance, particularly from project personnel, as a key barrier to effective lean implementation. This finding

aligns with earlier survey, interview, and case study insights, where resistance to change emerged as a recurrent obstacle to success.

Interestingly, traditional project management concerns, such as projects going above budget (1.04%) and falling behind schedule (3.13%), were not seen as major contributors to the failure of lean implementation. This departure from typical construction challenges suggests that the failure of lean implementation is more rooted in cultural and behavioral issues rather than logistical or financial concerns. These results emphasize the need to address human-centric aspects, particularly fostering stakeholder buy-in, overcoming resistance, and maintaining commitment to lean principles for long-term success in the construction industry.

The data from Question 18 highlights an important nuance: if lack of buy-in is defined as the primary indicator of failure, it cannot simultaneously serve as a contributing factor to that failure. Instead, lack of buy-in may represent the culmination of various barriers such as resistance to change, unclear communication, and insufficient leadership, all of which were identified in earlier survey questions. For example, Q15 revealed that resistance to change (4.22 mean) and inadequate communication (3.79 mean) were significant barriers, and these challenges likely contribute to the inability to achieve buy-in. Therefore, buy-in should not be viewed as an isolated issue but rather as an outcome shaped by multiple underlying factors. This perspective aligns with findings from the case study and interviews, which frequently emphasized the importance of trust, leadership, and clear communication as prerequisites for collective engagement.

The finding that 21.88% of respondents defined failure as "giving up on lean principles" also ties back to previous data points. For instance, Q16 and the case study revealed that unclear understanding of lean methodologies and the absence of immediate results often cause teams to abandon lean initiatives prematurely. This highlights the importance of fostering a culture of persistence and long-term commitment during lean implementation. Teams must recognize that lean principles often yield incremental, rather than immediate, benefits. Without this understanding, the expectation of short-term project performance gains may overshadow the broader, long-term value of lean practices, further exacerbating the risk of abandonment. It is important that this finding aligned well with the interview findings and influenced the researcher's own definition of failure while writing this thesis paper.

Additionally, while traditional project management concerns like budget and schedule scored low in defining failure, this does not necessarily mean these issues are irrelevant. Instead, it may suggest that participants perceive lean implementation challenges as more rooted in human-centric and process-related barriers rather than logistical constraints. However, this interpretation requires further investigation, as the goals of initial lean implementation (e.g., project performance vs. cultural transformation) were not explicitly defined in the data. This finding underscores the need for future research to explore how different stakeholder priorities shape their perception of lean success or failure. By addressing these varied perspectives, organizations can better align their strategies to meet both immediate and long-term goals.

Categorization of Themes

To categorize the fields into Human-Centric (HC), Process (P), and Resources (R), the researcher considered the underlying aspects and roles that each field played within the implementation of lean construction principles. Human-Centric (HC) factors focus on behaviors, relationships, and leadership dynamics essential for lean construction success. Fields like "Not achieving buy-in from the team" and "Experiencing resistance" clearly emphasize interpersonal dynamics, commitment, and the importance of building trust and engagement. Process (P) categories, such as "Giving up on lean principles" and "The project team did not improve," involve methods and practices that structure and manage lean workflows, focusing on the continuous improvement and application of lean tools. Resource (R) factors, such as "Contracts that penalize efficiency," "Project going beyond schedule," and "Project going above budget," highlight the logistical and contractual limitations that hinder lean implementation. This categorization helps provide a structured understanding of the distinct contributions of human, procedural, and resource-based elements in lean construction failures.

In addition to the reasons for lean implementation failure, several "Other" responses were provided by participants in Question 18, which required further categorization. The response "KPIs underwhelming" was categorized under "The project team did not improve" as it directly relates to inadequacies in performance measurement and achieving key indicators of success. The response "Not aligning participants around values" was classified as "Not achieving buy-in from the team," highlighting the need for value alignment as an essential aspect of collective commitment to lean principles. The

response "All of the above" was removed from the study as it lacked specificity and did not contribute distinct actionable insights. Lastly, "Contracts that penalize efficiency" was considered significant enough to warrant creating a new line item under resource-based issues, reflecting contractual challenges that can inhibit efficient project execution. This refined categorization provides greater clarity on the distinct contributions to lean implementation failures, effectively organizing these varied factors into actionable themes.

Answer	%	Count	Category
Not achieving buy in from Team (Trades, GC, Architect, Owner, Vendor, etc.)	44.79%	43	HC
Giving Up on Lean principles	21.88%	21	P
Experiencing resistance	18.75%	18	HC
The project team did not improve	9.38%	9	P
Contracts that penalize efficiency	1.04%	1	R
Project going beyond schedule	3.13%	3	R
Project going above budget	1.04%	1	R
Total	100%	96	

Category	%/Category
HC	64%
P	31%
R	5%

Table 14 Respondents definition of failure after hearing "failure to implement lean principles on a construction project for the first attempt", categorized by human-centric (HC), process (P), and/or resource (R).

Q19 – How optimistic are you about the success of future lean construction implementation attempts based on the lessons learned from the first attempt failures to improve project outcomes? (1=Not optimistic at all, 2=Not optimistic, 3= Neutral, 4=Slightly optimistic, and 5=Very optimistic)

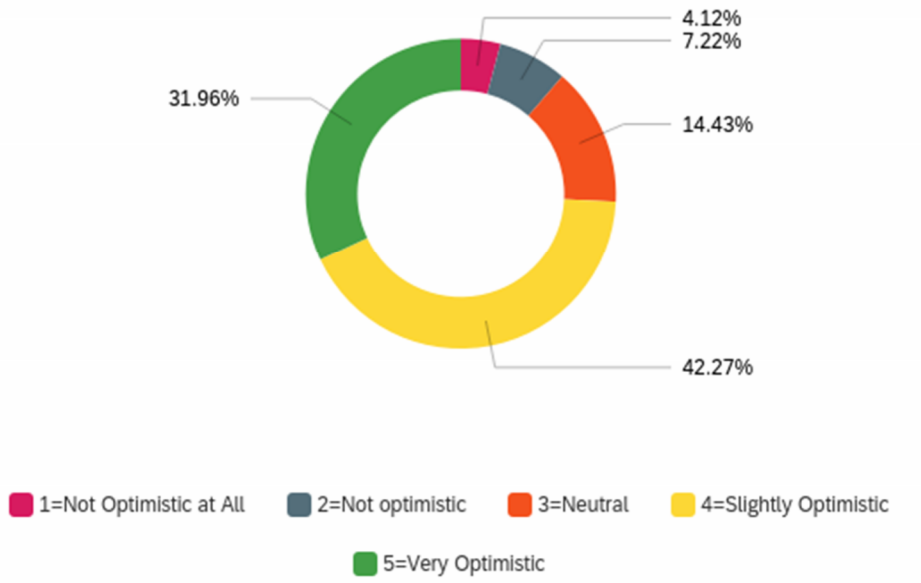

Figure 22 Respondent's optimism for lean construction implementation based on lessons learned from first attempt failures

The findings from Question 19 suggest that respondents generally hold an optimistic outlook regarding future lean construction implementation. A combined 74.23% of respondents expressed either slight (42.27%) or strong optimism (31.96%), indicating a belief that improvements can be made based on lessons learned from initial failures. This optimism raises important questions, particularly when contrasted with earlier findings such as Q17, where respondents largely perceived the construction industry's current lean implementation as ineffective. The data invites further inquiry: does this optimism reflect confidence in the potential of lean principles, or is it tied to expectations that systemic barriers, such as resistance to change or insufficient communication, can be overcome with targeted improvements?

The optimism expressed in Question 19 may be tied to the belief that addressing human-centric challenges, such as team buy-in, leadership, communication, and training, could lead to better outcomes in future attempts. For example, earlier findings in Q15 emphasized that resistance to change (mean 4.22) and inadequate communication (mean 3.79) were major barriers to lean implementation. Respondents might view these barriers as correctable, given the right emphasis on cultural and behavioral changes. However, the data does not directly establish that refining human elements within lean processes will necessarily resolve these challenges, leaving room for further investigation. These results raise the question of whether the construction industry has the tools and strategies in place to make these human-centric improvements effectively or whether optimism is rooted in hope rather than practical evidence.

Despite the optimism, 11.34% of respondents reported being either "not optimistic" (7.22%) or "not optimistic at all" (4.12%). This minority perspective raises questions about what specific barriers these respondents perceive as insurmountable. It may point to systemic issues, such as deeply entrenched cultural norms or structural resistance to change, which earlier findings in Q16 and the case study highlighted as recurring obstacles. The presence of this pessimism suggests that while many see opportunities for improvement, there are still doubts about whether lean principles can achieve widespread success in a construction industry that remains resistant to cultural and procedural shifts.

Overall, the findings from Question 19 indicate a complex relationship between optimism for future lean implementations and perceptions of the industry's current

effectiveness. While the data points to a belief in the potential for improvement, it raises important questions about the feasibility of overcoming the barriers identified in earlier questions. The optimism expressed may be an acknowledgment of lean's potential rather than a clear roadmap for achieving success. This invites further exploration into how the industry can translate lessons learned into actionable strategies to address resistance, foster collaboration, and maintain long-term commitment to lean principles.

Q20 – Please rate your level of agreement with this statement: "Addressing the root causes of lean construction implementation failures during initial implementation can positively influence the industry's perception of lean construction? (1=Strongly disagree, 2=Disagree, 3= Neutral, 4=Agree, and 5=Strongly agree)

Response	% of Respondents
Strongly Disagree (1)	2.06%
Disagree (2)	4.64%
Neutral (3)	10.82%
Agree (4)	39.18%
Strongly Agree (5)	43.30%

Table 15 Respondents' level of agreement with the statement.

The results from Question 20 reveal that a significant majority (82.48%) of respondents either "Agree" (39.18%) or "Strongly Agree" (43.30%) that addressing the root causes of lean construction implementation failures during the first attempt can positively influence the industry's perception of lean. This strong consensus highlights an industry-wide belief that identifying and mitigating the primary obstacles to lean

adoption such as resistance to change, inadequate communication, and lack of training, has the potential to improve how lean is perceived within the construction sector.

However, while the data suggests that addressing these root causes could influence perception, it does not necessarily demonstrate that such efforts will lead to broader adoption or acceptance of lean practices. This distinction is important because the question focuses specifically on perception rather than measurable changes in implementation outcomes. Further research would be needed to explore whether improving perception directly correlates with increased adoption rates or more effective integration of lean principles across projects.

The high levels of agreement in this question also raise important questions when contrasted with earlier findings. For example, in Q17, respondents indicated that the construction industry is only slightly or moderately effective at implementing lean, suggesting significant skepticism about current practices. Yet in Q19, most respondents expressed optimism about future lean implementations. This contrast between perceptions of current effectiveness and future potential suggests that while skepticism persists, there is hope that addressing root causes of failure could lead to meaningful change. This raises a key question: what specific strategies or interventions do respondents believe would effectively address these root causes and shift the perception of lean within the industry?

In summary, the data from Question 20 highlights a strong belief in the importance of addressing barriers to improve the perception of lean construction. While this belief aligns with the broader themes of this research, particularly the role of human

factors such as trust, collaboration, and communication it does not definitively prove that perception improvements will lead to greater lean adoption or acceptance. These findings point to an opportunity for further research to explore the connection between perception and implementation outcomes and to identify actionable strategies for addressing the root causes of lean implementation failures.

Q21 – Rank these 11 factors that contribute to the success of lean construction implementation on the first attempt. Please drag them into the order you are ranking them with 1=Most Important and 11=Least Important.

Categorization of Themes

Field	Mean	Category
Project Team Commitment	3.06	HC (Human Centric)
Leadership Support and Buy In	3.28	HC (Human Centric)
Respect for People	3.57	HC (Human Centric)
Team Trust	4.12	HC (Human Centric)
Project Team Discipline	5.26	P (Process)
A lean champion	5.68	HC (Human Centric)
Visual Communication	7.15	P (Process)
Measured Accountability	7.49	P (Process)
Need a problem to solve	7.72	R (Resource)
Child-like wonder	8.56	HC (Human Centric)

Table 16 Categorization of main factors contributing to the success of lean construction as recommended by interviewees and ranked by the industry wide survey.

This question asked each survey participant to rank provided options in order of 1-11, with 1 being the most important and 11 being the least important. The response options were derived directly from interviews with four seasoned lean leaders who ranked their top factors contributing to lean success. Their responses were categorized

into three themes: Human-Centric (HC), Process (P), and Resource (R), to organize and analyze the underlying roles of each factor in lean construction implementation.

Human-Centric (HC): Trust, leadership, respect, commitment, discipline, and other behaviors or relationships that emphasize the human element in lean construction. For example, "Project Team Commitment," "Respect for People," and "Leadership Support and Buy-In" fall within this category because they directly involve fostering engagement and alignment among individuals. Process (P): Methods or tools related to the structure and facilitation of work, such as "Visual Communication," "Measured Accountability," and the role of "A Lean Champion," which support effective implementation by providing clarity, structure, and guidance. Resource (R): Goals or tangible inputs necessary for optimizing lean implementation, such as "Need a Problem to Solve," which focuses on identifying project-specific opportunities to drive lean practices.

The top-ranked factors in the survey fell predominantly within the Human-Centric category, with "Project Team Commitment" (Mean = 3.06) and "Leadership Support and Buy-In" (Mean = 3.28) ranking as the most important. This reflects the critical role of fostering alignment, engagement, and accountability among team members. Leadership support not only encourages collaboration but also sets the tone for team commitment, ensuring that lean principles are integrated into the team's daily practices. "Team Trust," another highly ranked factor, highlights the importance of creating an environment where individuals feel respected, valued, and aligned around common goals.

However, while trust and respect both fall within the Human-Centric category, they influence different groups and functions. Trust primarily focuses on intra-team relationships, building a collaborative culture that minimizes conflict and maximizes cohesion. Respect, on the other hand, emphasizes valuing the contributions of individuals, particularly the workforce responsible for executing the physical aspects of the project. The alignment between these factors lies in their mutual reinforcement: trust cannot thrive without respect, and respect fosters the conditions for trust to develop. Misalignment in these areas, such as a lack of respect for workers while expecting trust among team members, can undermine the very cohesion required for lean success.

Process-oriented factors, such as "Visual Communication" and "A Lean Champion," were also recognized as important contributors. Visual communication ensures that teams have a shared understanding of goals, progress, and obstacles, which aligns with lean's emphasis on clarity and waste reduction. The role of a Lean Champion further supports the process by acting as a consistent advocate and guide, helping teams adhere to lean principles while adapting them to project-specific contexts. Misalignment in these areas—such as unclear visuals or inconsistent guidance from the Lean Champion—can lead to confusion, disengagement, and a breakdown in the implementation process.

Resource-related factors, such as "Need a Problem to Solve," highlight the importance of grounding lean initiatives in specific, actionable goals. This aligns with lean's focus on value creation and waste elimination. However, when metrics or resources are misapplied such as using metrics as control mechanisms rather than tools

for improvement, they can hinder progress and erode team morale. This finding underscores the need for balanced resource utilization that supports, rather than undermines, the human and procedural elements of lean implementation.

While the findings emphasize the human-centric nature of lean success, it is important to note that most of the survey's ranked factors fell within the Human-Centric category. This raises a question about the survey's structure: If most factors presented to respondents were human-centric, does this skew the results toward a human-centric conclusion? To strengthen the argument, future research could balance the distribution of factors across the three categories to assess whether process or resource factors might emerge as equally significant when given greater representation.

Additionally, these results raise the question of whether failure should be defined as the absence of success or as a spectrum that includes partial success and missed opportunities. For example, some teams might experience moderate success in implementing lean principles but ultimately abandon the effort due to insufficient buy-in or unclear results. These scenarios suggest that success and failure are not binary but exist along a continuum influenced by the interplay of human, process, and resource factors.

Finally, the emphasis on human-centric factors invites further exploration into how these elements can be practically integrated with process and resource strategies to create a more holistic approach to lean implementation. While the data highlights the importance of commitment, leadership, and trust, it also underscores the necessity of

leveraging tools, visual aids, and defined goals to support human effort. Balancing these dimensions remains critical to achieving sustained success in lean construction practices.

Q22 – Please provide your email address if you are interested in following up with the results of this research.

This survey question was included to provide respondents with an opportunity to remain engaged with the research as it progresses. The data collected through various sources, including interviews, case studies, and surveys, consistently highlight the challenges associated with the initial implementation of lean principles in construction projects. With 66 of the 116 respondents indicating their interest in receiving follow-up information, it is evident that the topic of lean implementation is of significant concern to industry professionals. Upon the completion of this research, a full report, including the findings and analysis, will be shared with those respondents who provided their email addresses, ensuring that they have access to the results and insights generated from this study.

Q23 – Do you have any additional comments or suggestions related to first attempt lean construction failures and/or their implications on the industry's perception of lean construction?

Theme	Keywords/Phrases Mentioned	Frequency
Leadership Engagement	"leadership", "CEO didn't understand the value", "leadership buy-in", "champion", "leaders", "pressure"	7
Respect for People	"respect for people", "respect", "team health", "people", "read the room"	6
Communication and Clarity	"communication", "clear expectations", "explain and address questions", "roles", "expectations"	6
Training and Standards	"better training content", "focused set of standards", "more training", "standardized training"	5
Incremental Implementation	"starting with incremental concepts", "start small", "incremental wins", "gradual"	5
Team Engagement	"team engagement", "collaboration", "team buy-in", "post-mortem meetings"	5
Cultural Resistance	"resistance to change", "multi-generational builders", "pushback", "negative impressions"	4
Business Value	"value from a business standpoint", "not for personal notoriety", "project and team health"	4
Gradual Change Management	"overcome resistance", "start small", "gradual change"	4
Tools Over Principles	"focus on tools", "lean is more than tools", "buzzwords", "sticky notes", "Last Planner"	4
Misunderstanding of Lean	"misunderstanding lean", "thinking lean is like manufacturing", "don't understand principles"	3
Long-Term Commitment	"PDSA", "long-term commitment", "sustain", "improvement", "resilience"	3

Table 17 Respondent's additional comments related to first attempt lean failures

Based on the responses to Question 23, twelve key themes emerged, highlighting challenges and areas for improvement in first-time lean construction implementations. One of the most frequently mentioned themes was leadership engagement, cited 7 times, with respondents emphasizing the importance of leadership buy-in and understanding. For example, one respondent noted that the CEO did not understand the business value of

lean, which hindered its implementation. This suggests that leadership must not only support lean initiatives but also comprehend their long-term benefits to sustain their effectiveness. However, additional surveys or interviews would be needed to validate this conclusion and determine how widespread this challenge is across the industry.

Another recurring theme, mentioned 6 times, was the need for communication and clarity. Respondents pointed to the lack of clear communication during lean implementation processes, particularly at project kick-off meetings. Without proper onboarding and opportunities to address questions, teams and trade partners were often left confused about their roles and expectations. This observation is grounded in survey responses but also aligns with findings from the case study, where unclear communication was linked to resistance and disengagement among team members. Similarly, miscommunication during implementation phases was identified as a significant barrier to aligning teams around lean objectives.

Respect for people emerged as another critical factor, mentioned 6 times. Respondents emphasized that lean construction principles cannot succeed without respect for the people performing the work. This respect was tied directly to team health and the long-term sustainability of lean practices. For instance, the survey responses linked respect for people with team engagement (mentioned 5 times) and collaboration (mentioned 5 times), noting that fostering these elements is essential for building trust and commitment among project teams. While these themes align with the emphasis on human-centric factors discussed throughout the research, further investigation is needed

to determine how respect for people influences specific lean outcomes and whether it consistently emerges as a top factor across different project types.

Cultural resistance to lean construction, particularly among multi-generational builders, was cited 4 times as a barrier to implementation. Resistance to change and adherence to traditional practices were highlighted as major stumbling blocks during the early stages of lean adoption. Respondents suggested starting small with incremental changes, an approach mentioned 5 times, to overcome resistance and build momentum. This incremental strategy was also reflected in the case study, where smaller pilot initiatives successfully demonstrated lean principles and gradually gained buy-in from initially skeptical stakeholders.

The survey results also revealed a lack of understanding and confusion about what the term "lean construction" means, contributing to both the failure of first-attempt implementations and the industry's perception of lean construction. For example, responses to Q15 highlighted that many team members lacked sufficient training or knowledge of lean principles, leading to superficial applications that failed to deliver meaningful outcomes. The triangulated method used in this research further supports this observation, as interviews and the case study demonstrated a gap between how lean principles are conceived in theory and how they are applied in practice. One case study participant expressed this disconnect, stating that "lean felt more like a checklist than a mindset," highlighting the lack of strategic focus on the cultural and behavioral aspects of lean.

While the research emphasizes respect for people as a key theme in the success of lean construction, it does not yet fully prove that this is the singular "missing link" to successful implementation. Instead, the findings suggest that respect for people is one of several critical factors, alongside communication, leadership, and incremental cultural change, that contribute to lean's success or failure. These interconnected human-centric elements provide a foundation for improving lean adoption but require further validation through additional data collection and analysis to confirm their relative importance across diverse construction contexts.

A Findings Conversation with Dr. Bob Emiliani

The researcher was fortunate to connect with Dr. Bob Emiliani via LinkedIn and received an almost immediate response expressing his excitement to participate in the research project. Dr. Emiliani, a prominent thought leader in lean management, leadership, and organizational transformations, was heavily cited within the literature review section of this study. He has authored 28 books and 40 white papers, six of which focus solely on the reasons for lean failures.

After spending roughly two hours on a Zoom meeting reviewing the survey data, Dr. Emiliani made a statement that perfectly summarized the findings: “These results prove that no one knows what the hell lean means in the Construction industry.” (Hoots, A. & Emiliani B., 2024). This observation reflects the core issues identified in multiple data points throughout the research.

The first major result supporting this conclusion comes from Q15, where respondents highlighted "Resistance to Change" (mean 4.22) and "Lack of Understanding of Lean Principles" (mean 4.13) as the top barriers to lean implementation. This indicates that a significant gap in lean knowledge persists across project teams, contributing to superficial or misaligned applications of lean principles. Similarly, responses to Q20, where 82.48% of respondents agreed or strongly agreed that addressing the root causes of lean implementation failures could improve the industry's perception of lean, reflect a recognition of foundational misunderstandings within the industry.

Dr. Emiliani's statement is further corroborated by responses to Q23, where several participants explicitly mentioned confusion around the meaning of lean construction as a factor contributing to implementation failure. One respondent noted, "Teams don’t know if lean is a set of tools, a mindset, or a process, which makes it impossible to align on expectations." This disconnect was also evident in the triangulated case study and interview findings, where participants frequently described lean as being treated more like a checklist than a holistic system, reflecting a lack of comprehension of its underlying philosophy.

Finally, the survey results from Q19 reveal a notable contrast: while most respondents expressed optimism for future lean implementation, many still perceived the current effectiveness of lean in the construction industry as low (Q17). This duality underscores the confusion and inconsistency in how lean is understood and applied, as teams struggle to bridge the gap between theoretical principles and practical implementation.

Collectively, these results substantiate Dr. Emiliani's pointed critique. The lack of a unified understanding of lean construction within the industry remains a key obstacle to its successful adoption. This insight highlights the urgent need for better education, clearer communication, and consistent leadership to foster a more accurate and shared comprehension of lean principles in construction.

CHAPTER VII

CONCLUSION

This research has delved deeply into the intricate challenges and opportunities surrounding the initial implementation of lean principles in construction projects. While lean construction, adapted from the manufacturing sector, offers the potential to develop people, enhance efficiency, eliminate waste, and deliver projects that meet or exceed stakeholder expectations, the transition from traditional construction management to lean remains fraught with obstacles. The findings from the case study, interviews with seasoned lean professionals, and comprehensive survey data illustrate the complexity of lean adoption in the construction industry.

The case study of the Higher Education Dormitory and Dining Facility project identified several failure points during the first attempt at lean implementation. A lack of trust, insufficient leadership support, and inadequate buy-in from key stakeholders were evident, alongside the misalignment of lean tools with project needs. These issues resulted in costly overruns, schedule delays, and ultimately, a general disillusionment with lean practices. Furthermore, the misapplication of lean tools as a "check-the-box" exercise rather than a value-driven process exacerbated these challenges, demonstrating that lean principles cannot simply be overlaid onto traditional construction methods without careful consideration and planning.

Interviews with veteran lean professionals revealed recurring human-centric themes that are critical for lean success. Trust-building, leadership empathy, and team engagement were identified as foundational to lean implementation. Resistance to

change, the need for continuous education, and the perception of failure were also discussed as core issues that undermine lean implementation efforts. These conversations emphasized that lean principles succeed when they are not only understood technically but also culturally embedded within teams, reinforcing that lean construction is as much about people as it is about process.

Survey results reinforced the human-centric themes of the case study and interviews. A significant portion of respondents noted the lack of clear communication, understanding, and resources as barriers to lean adoption. A striking 71% of respondents disagreed or strongly disagreed that the construction industry has a clear grasp of what lean entails, highlighting the need for further education and alignment within the industry. In question after question, resistance to change, a lack of leadership buy-in, and inadequate team engagement were common themes. Respondents repeatedly pointed out the misapplication of lean principles, particularly when they were used to exert control or as a "weapon" against teams, rather than to foster collaboration and continuous improvement.

Data Source Triangulation

Theme	Category	Case Study	Interviews	Survey
Lack of Trust	Human-Centric	Lack of relationship-building and transparency led to disengagement from trade partners (observed in 3 different project phases). Specific examples include instances where miscommunication between contractors and subcontractors led to mistrust.	Participants #1, #3, #4 emphasized trust-building as foundational to lean implementation (mentioned 12 times).	Lack of buy-in and commitment noted; systemic lack of trust identified (Q13 - 22 mentions, Q14 - 10 mentions).
Leadership Support	Human-Centric	Insufficient leadership support and empathy were significant issues. Specific examples include project managers failing to engage in daily check-ins with their teams.	Leadership empathy and engagement highlighted as essential for lean success by Participants #2, #3, #4 (mentioned 15 times).	Leadership support and buy-in cited as crucial (Q12 - 18 mentions, Q23 - 7 mentions).
Team Buy-In	Human-Centric	Poor buy-in from key stakeholders led to challenges in lean implementation.	The importance of team engagement and buy-in was emphasized by all interviewees (mentioned 14 times).	Buy-in consistently identified as a success factor (Q12 - 22 mentions, Q18 - 37 mentions).
Rigid Application of Lean	Process	Misalignment of lean tools with project needs; applied rigidly without adaptation.	Need for flexibility and adaptability in lean practices highlighted by Participants #1, #2, #4 (mentioned 9 times).	Tools seen as rigid; misuse and misunderstanding of tools noted (Q15 - 15 mentions, Q13 - 10 mentions).
Visual Management	Process	Minimal use of visual management tools contributed to communication issues.	Participants #2, #3 advocated for increased use of visual tools to aid communication (mentioned 8 times).	Lower scores for "Establish clear production goals visually" (Q9 - mean score 3.09).
Daily Huddles & Accountability	Process	Lack of effective daily meetings or accountability methods observed (noted during 4 project site visits). Specific examples include missed daily huddles resulting in confusion about task responsibilities.	Daily huddles and accountability discussed as critical for maintaining momentum by Participants #3, #4 (mentioned 11 times).	Variability in successful trade partner engagement suggested lack of consistent huddles (Q14 - 9 mentions).
Understanding Lean Principles	Human-Centric	Limited understanding of lean principles led to implementation issues.	Participants #1, #3 expressed a need for better education and shared understanding (mentioned 10 times).	Lack of understanding was a significant barrier (Q15 - 19 mentions, Q16 - 71% disagreed).
Misuse of Metrics	Resources	Metrics used as control rather than as a tool for improvement.	Interviewees highlighted the importance of using metrics for value-driven processes (mentioned 7 times).	Misuse and misunderstanding of metrics identified as barriers (Q13 - 10 mentions).

Table 18 Triangulated themes from each stage of research categorized by HC, P, R

Table 18 above provides a comprehensive triangulation of key themes and categories that emerged across three different sources of data: the case study, interviews with seasoned lean leaders, and industry-wide survey results. By examining each theme in the context of the case study, the interviews, and the survey, the researcher can identify recurring issues that contributed to the failure of lean construction initial implementation. The themes of trust, leadership support, understanding of lean principles, and team buy-in consistently emerged as factors influencing the success or failure of lean construction efforts. These factors, identified in both qualitative and quantitative data, provide important insights into why the initial lean principles fail on the initial implementation of lean principles on construction projects.

The triangulation of data from the case study, interviews, and surveys revealed that these three categories and their associated themes are interdependent, and their interplay significantly affects the implementation of lean principles. Addressing these challenges requires a holistic approach that balances human dynamics, process adaptability, and resource optimization. In analyzing the triangulated themes and causes of lean construction failure such as: lack of trust and buy-in, leadership commitment issues, misuse of lean tools, misunderstanding of lean principles, resistance to change, and communication gaps, it becomes clear that these factors often reinforce one another, creating reinforcing loops that contribute to project failure. This interconnectedness is best understood through a systems thinking lens, which emphasizes the relationships between components within a system and how those relationships can create feedback loops that either support or undermine project goals. For example, a lack of leadership commitment often leads to poor buy-in from team members, which in turn results in resistance to change and ineffective communication. The failure to build trust and communicate effectively creates an environment where the misuse of lean tools becomes more likely, further diminishing team morale and engagement.

These reinforcing loops make it difficult to identify a singular root cause or determine the largest contributing factor to lean implementation failure. Instead, the issues within the system collectively drive failure, often amplifying each other. This complex web of factors presents a limitation for this research, as the overlapping and reinforcing nature of these causes makes it challenging to isolate specific failures for targeted interventions.

In the case study, lack of trust was a contributor to the failure of lean principles. The project team did not focus on building relationships or creating transparency, which led to disengagement from trade partners. This issue was echoed in the interviews, where participants emphasized the need for trust and collaboration among project teams to effectively implement lean practices. The survey data further validated this theme, with respondents indicating that lack of trust was a significant barrier to successful lean implementation. Similarly, leadership support and team buy-in were highlighted as themes across all three sources, underscoring the need for leadership to actively participate in and support lean efforts, while also ensuring that the entire project team is fully committed to the process.

Additionally, the need for flexibility in applying lean principles was consistently emphasized in all three data sources. In the case study, lean practices were applied rigidly, without adapting to the project's specific context, which led to frustration among the team. Interviewees shared similar concerns, stating that lean must be flexible and tailored to the specific needs of each project. The survey results confirmed this, with respondents noting that lean success depends on adaptability and flexibility rather than strictly following a prescribed process. Other factors such as visual management, daily huddles, and the appropriate use of metrics were also identified as important themes that, if properly addressed, could have prevented the failure of lean principles on this project.

One of the key findings from this research is the identification of three overarching categories that influenced the failure of lean construction: Human-centric factors, Process related issues, and Resources. These high-level themes consistently

emerged across the research steps, serving as crucial determinants of the success or failure of lean implementation.

Human-Centric factors, such as lack of trust, leadership support, and team buy-in, were highlighted as major failure points. The research found that effective trust-building, empathetic leadership, and strong team engagement are foundational for successful lean construction. Process-related themes, including the rigid application of lean, inadequate visual management, and inconsistent daily accountability practices, emerged as significant challenges. Lastly, Resource-based issues, particularly the misuse of metrics, highlighted the importance of properly utilizing performance metrics to foster continuous improvement rather than control. Notably, Resources were not mentioned nearly as often as human-centric and process as contributors to the failure to initially implement lean principles on a construction project.

While this research emphasizes the necessity of a balanced, human-focused approach to lean construction, it is important to clarify that the findings suggest this conclusion rather than definitively prove it. For example, the consistent themes of trust, leadership support, understanding of lean principles, and team buy-in indicate the critical importance of human dynamics, but further research is needed to determine the extent to which these factors outweigh process or resource considerations. Additionally, the interplay between human-centric and process-related issues—such as communication breakdowns and rigid application of lean tools—suggests that success depends on the intentional integration of all three categories. Future studies should explore how these

factors interact over time and within different project contexts to better understand their collective impact.

Despite the obstacles highlighted, optimism remains a key takeaway. A large portion of respondents expressed hope for future lean initiatives, with over 74% indicating that they were either “slightly” or “very” optimistic about future attempts to implement lean based on lessons learned. This indicates a recognition that, while lean may falter initially, there is significant room for growth, especially if the construction industry can adopt a more human-centric approach that values people and fosters trust, communication, and collaboration.

The survey’s high optimism for future lean implementation (74% of respondents were slightly or very optimistic) contrasts with the industry’s perceived ineffectiveness in current lean practices. This contrast raises important questions: Does optimism reflect confidence in lean’s potential, or is it rooted in the hope that ongoing challenges such as resistance to change, communication gaps, and leadership buy-in can be resolved? While optimism is encouraging, it must be accompanied by actionable strategies to address systemic issues identified in this research. Clear communication, respect for workers, and leadership commitment must move beyond abstract ideals to become measurable, actionable priorities that guide lean adoption on future projects.

Potential for Bias

The survey sample utilized in this study was largely composed of individuals who demonstrated a pre-existing enthusiasm for lean construction, with many participants

actively engaged in lean-related practices or communities. This introduces a notable potential for bias, particularly concerning the second research question, which explores the respondents' optimism regarding the future of lean construction. The inherent positive predisposition of these participants may have led to an overrepresentation of favorable attitudes towards the potential success and applicability of lean principles. Consequently, the findings might reflect an overly optimistic view, failing to capture a balanced representation that includes those who are more skeptical or critical of lean construction practices. This selection bias could have implications for the generalizability of the results, potentially skewing the data towards a more favorable perspective on lean adoption than might be observed within a broader, more representative population of construction industry professionals.

To mitigate this potential bias, two measures were taken. First, the survey was distributed not only to those already familiar with lean construction but also to broader networks such as the Old Dawg community via email and to the Industry Advisory Board associated with Clemson University. Second, the researcher, who has extensive knowledge of the lean community, was able to identify only approximately 20% of the respondents as members of the lean community, suggesting that the sample did include perspectives beyond those predisposed to lean methodologies. These efforts aimed to ensure that a more diverse range of opinions was included, thereby providing a more balanced view of the industry’s perception of lean construction and its future potential.

In conclusion, this research illustrates the necessity of a balanced, human-centric approach to lean construction. Process (Technical tools) alone cannot drive success;

rather, the people implementing them, along with the culture of the teams and organizations they work in, must be engaged, supported, and aligned with lean principles. Addressing leadership buy-in, creating an environment of trust, fostering respect for people, and offering continuous training will be key to overcoming the common failure points identified in this research. By focusing on both the human, process, and resource aspects of lean, the construction industry can fully realize the transformative potential of lean principles, reshaping the industry's perception and experience with lean principles. This study paves the way for further exploration into sustainable strategies that can make lean construction an enduring success in the industry.

CHAPTER VIII

FUTURE RESEARCH OPPORTUNITIES

Future Research Opportunities

The journey of lean construction implementation is marked by both successes and setbacks, providing fertile ground for further exploration and innovation. The insights provided by this research have illuminated several key areas that warrant deeper investigation to enhance the value and acceptance of lean principles in the construction industry. By identifying, then addressing these areas, future research can contribute to the development of more robust, adaptable, and human-centric lean practices. Future research stemming from this study offers a range of opportunities to deepen the Construction Industry's understanding of how to increase the likelihood of successfully implementing lean construction principles on Construction projects. The researcher has collected quality data that could be categorized and broken down in several ways. The researcher plans to further develop this thesis through Journal papers involving the following topics:

First Principles and Theory of Lean Implementation:

Investigate the impact of grounding lean construction practices in foundational theories and first principles. Determine if a deeper theoretical understanding leads to more successful lean implementations. What is the best and most effective way to teach

lean construction? This opportunity emerged from the consistent mention in both the case study and interviews about the need for a fundamental understanding of lean principles before applying them, which was often lacking in the projects surveyed. Furthermore, conversations with Dr. Milberg inspired this topic as future research.

Respect for People in Construction:

Conduct a detailed study on what "respect for people" means within the construction industry and how people currently practice “respect for people”. Explore practical ways to integrate this principle into everyday construction practices and measure its effects on lean implementation success. This research direction stems from the frequent mention of human-centric factors across the case study, interviews, and survey responses, emphasizing the importance of interpersonal relationships and empathy in successful lean adoption.

Familiarity with Lean Tools:

Explore why there is a greater familiarity with Pull Planning compared to the comprehensive Last Planner System. Examine how focusing on specific tools rather than holistic systems affects lean outcomes. This research would further explore Systems Thinking and the link with assisting teams to implement lean principles on construction projects. Survey findings indicated a disparity between familiarity with individual tools versus the overall Last Planner System, which highlights the need to explore the impact of partial versus holistic lean adoption.

Personal vs. Industry-Wide Lean Implementation Challenges:

Compare and contrast the researcher's personal experiences with lean implementation challenges to industry-wide findings from interviews and surveys. Identify common and unique obstacles and strategies. The contrasting nature of the researcher's case study and the industry-wide data led to the realization that personal experiences can differ significantly from general industry trends, necessitating a comparative study.

Building Trust Through Leadership Practices:

Investigate how supervisors and managers can effectively build trust and respect among their teams. Examine the role of empathy and attention in achieving natural buy-in and improving lean adoption. Furthermore, explore some of the researcher’s own methods with making, maintaining, and measuring trust on Construction projects. This was identified as a future research area based on the frequent mention of the lack of trust as a barrier to successful lean implementation in both the case study and interviews.

Developing a Lean Problem-Solving Ethos:

Study how to develop and instill a problem-solving mindset alongside lean methodologies in construction professionals. Focus on strategies that ensure lean principles are applied in ways that benefit frontline workers. The need for a problem-solving ethos emerged as a consistent theme throughout the interviews and case study,

highlighting the importance of addressing issues at their core and empowering workers with the tools and mindset necessary to solve problems.

Future Means and Methods of Construction Project Delivery:

Propose and evaluate innovative construction project delivery methods that integrate lean principles into organizational inertia construction practices. Explore how educational institutions can better prepare students for these future practices. Develop graduate level courses that assist students in understanding and applying these new means and methods for Construction Project Delivery. Survey data showed a gap in familiarity with future-oriented lean methods, suggesting a need to equip students and young professionals with practical skills for future construction industry challenges.

Narcissism in the Construction Industry:

Conduct a study on the prevalence and impact of narcissism within the construction industry. Explore how a lack of empathy and care affects teamwork, lean implementation, and project outcomes. This research direction was inspired by the interviews, which frequently touched on interpersonal dynamics and implied an impact of personality traits on team cohesion and lean success.

Personal Relationship Status of Construction Leaders:

Examine how the personal relationship status (e.g., marital status, family dynamics) of construction leaders impacts their approach to lean implementation, team dynamics, and overall project success. The researcher's observations during the case

study, combined with interview insights, suggested that personal life dynamics could have an unexamined impact on leadership effectiveness and team cohesion.

Definition and Perception of Lean Construction Failure:

Investigate what constitutes a failure in lean construction from various stakeholder perspectives. Examine how different definitions and perceptions of failure influence lean adoption and continuous improvement efforts. The interview results revealed that different stakeholders had divergent understandings of what constitutes failure, suggesting the need for a clear and standardized definition to better evaluate lean construction outcomes.

Identified bias truth (overly optimistic lean advocates)

Future research should focus on determining whether the identified bias influenced the study's findings, particularly the optimism towards the future of lean construction. Expanding the sample to include a more diverse set of construction professionals, including skeptics of lean practices, could provide a more balanced outlook. Conducting longitudinal studies and qualitative interviews with those less familiar with or skeptical of lean would help capture a broader range of perspectives. A mixed-methods approach involving both statistical analysis and rigorous qualitative triangulation would also contribute to validating the findings and reducing bias. The potential bias identified in the survey results suggests a need to validate the optimistic outlook of lean advocates with additional research that includes less biased perspectives.

A Deeper Understanding of the Lean Principles or Tools that Construction Professionals struggle with and why:

Future research should explore the deeper reasons behind the challenges in implementing certain lean principles, such as Takt Planning and Value Stream Mapping, which were identified as the most difficult by respondents. Additionally, the apparent ease with which some professionals report integrating relational tools like Respect for People and Feedback into their practices warrants further investigation to determine whether this is due to greater familiarity or if these principles are less emphasized in lean construction training and application. A more nuanced understanding of the balance between technical and relational lean principles could help bridge the gap between theory and practice in lean implementation, ensuring that both aspects are given adequate attention in future lean construction strategies. The survey responses to Question 7 indicated significant challenges with specific lean tools, suggesting the need for deeper exploration into why these challenges exist and how they can be addressed.

The proposed future research directions outlined above represent a crucial step forward in advancing the field of lean construction. Each area of study has been carefully identified based on the insights gathered from this research, highlighting both the successes and the challenges encountered during the initial implementation of lean principles on Construction projects. By focusing on foundational theories, understanding the human element, exploring the impact of leadership practices, and investigating the various aspects of lean adoption, these research opportunities aim to address the multi-layered nature of lean construction.

This research identifies ten key areas for future exploration to enhance the implementation of lean principles in construction projects. Central to this exploration is the principle of "respect for people," which requires a deeper understanding of its application within the construction industry. Alongside this, building trust through empathetic leadership, fostering a problem-solving mindset, and investigating the role of personal dynamics and narcissism in the industry are crucial. These areas, rooted in the human element of lean construction, provide a roadmap for more sustainable and effective lean implementations.

Future studies could also benefit from examining the impact of foundational lean theories on practice, as well as the specific lean tools, like Pull Planning, which seem more familiar to practitioners compared to holistic systems such as the Last Planner System. By addressing these issues, the construction industry can better understand lean principles and adopt them in ways that go beyond technical requirements, emphasizing the importance of people, leadership, and culture. This research aims to shift industry perception and ensure that lean principles not only meet operational goals but also respect and empower the individuals involved in construction projects.

Categorization of Future Research

The journey of lean construction implementation is marked by both successes and setbacks, providing fertile ground for further exploration and innovation. This study has illuminated several key areas for future research, each of which aims to further understand and address the complexities involved in lean construction practices. These

research areas can be divided into Human-Centric (HC), Process (P), and Resource (R) themes, ensuring a comprehensive analysis of how to enhance lean construction across different facets of a project.

Human-Centric future research opportunities focus on enhancing leadership practices, understanding interpersonal dynamics, and addressing the human element of lean construction. For instance, studying what "respect for people" means within the construction industry and how to integrate it into everyday practices is fundamental. Similarly, understanding how empathy and attention from supervisors can build trust and lead to natural buy-in is crucial for lean adoption. Moreover, investigating the influence of personal relationship status or narcissistic tendencies among construction leaders will provide valuable insights into how personal dynamics affect the implementation of lean principles. By exploring these human-centric topics, the research can ultimately ensure that lean principles not only foster operational improvements but also support and empower individuals involved in construction projects.

Process-focused research opportunities involve examining the foundational theories of lean, the use of specific tools and methodologies, and how to address implementation challenges. Topics like grounding lean practices in first principles, investigating why some lean tools are more familiar than others, and understanding the effectiveness of different problem-solving strategies are essential to enhancing lean adoption. Moreover, it is crucial to evaluate innovative project delivery methods and explore how educational institutions can better prepare students to implement these methods in practice. Understanding how to develop a problem-solving ethos among

construction professionals that complements lean methodologies will further strengthen the procedural aspects of lean implementation and enhance construction efficiency.

Research related to Resource elements is another critical focus. Evaluating the means and methods of future construction project delivery, particularly integrating lean principles into traditional resource-heavy practices, will offer new insights into optimizing resources for lean success. By addressing these areas and understanding the interplay between human dynamics, procedural rigor, and resource allocation, future research can contribute to creating a more robust, adaptable, and effective approach to lean construction.

Future Research Topic	Category
First Principles and Theory of Lean Implementation	P
Respect for People in Construction	HC
Familiarity with Lean Tools	P
Personal vs. Industry-Wide Lean Implementation Challenges	HC
Building Trust Through Leadership Practices	HC
Developing a Lean Problem-Solving Ethos	HC, P
Future Means and Methods of Construction Project Delivery	P, R
Narcissism in the Construction Industry	HC
Personal Relationship Status of Construction Leaders	HC
Definition and Perception of Lean Construction Failure	HC, P
Identified Bias Truth (Overly Optimistic Lean Advocates)	HC
Lean Principles or Tools Construction Professionals Struggle With	P

Table 19 Categorization of Future Research

The future research opportunities outlined above represent the next step in advancing lean construction. They have been carefully identified based on the insights gathered from this research, emphasizing both the successes and challenges encountered during lean implementation. By focusing on foundational theories, leadership practices, human elements, procedural efficiency, and resource optimization, these research opportunities aim to enhance lean adoption. Ultimately, the goal is to shift industry perception and ensure that lean construction principles are applied not only for operational success but also to respect and empower the individuals working in the industry.

APPENDICIES

APPENDIX A
Survey Questions:

Lean Construction Failures Final REV

Survey Flow

Block: Hoots Thesis Questions (23 Questions)

Page Break

Start of Block: Hoots Thesis Questions

Q1 What is your name? (optional)

_____

Q2 What is your role in the Construction Industry?

- ○ Intern or Project Engineer (1)
- ○ Assistant Project Manager or Project Manager (2)
- ○ Assistant Superintendent or Superintendent (3)
- ○ Lean Champion (4)
- ○ Project Executive (5)
- ○ Corporate Executive (6)
- ○ Other (7) _____

Q3 How many years of experience do you have as a construction professional?

- ○ 0-2 years (1)
- ○ 3 to 5 years (2)
- ○ 6 to 10 years (3)
- ○ 11 to 20 years (4)
- ○ 21+ years (5)

Q4 What is your level of maturity with regards to applying lean principles on a construction project?

	1=No Knowledge (1)	2=Limited Knowledge (3)	3=Basic Understanding (4)	4=Proficient (5)	5=Expert (6)
Click to write Choice 1 (1)	○	○	○	○	○

Q5 How much training have you had on applying lean principles to construction projects throughout your lifetime? (1=No Training, 5=Training Routinely)

	1=No Training (0 hours) (1)	2=A little training (Less than 100 hours) (2)	3=I have had training (101-1000 hours) (3)	4=I train when I can (1,001 - 10,000 hours) (4)	5=I train routinely (10,001+ hours) (5)
Rating (1)	○	○	○	○	○

Q6 Please identify how familiar you are with the following principles or tools:

	1=Unaware (1)	2=Aware (2)	3=Understanding (3)	4=Competent (4)	5=Mastery (6)
Define Value (1)	○	○	○	○	○
PDCA (2)	○	○	○	○	○
Pull Planning (3)	○	○	○	○	○
Map Value Stream (4)	○	○	○	○	○
Create Flow (5)	○	○	○	○	○
Respect for People (6)	○	○	○	○	○
Establish Pull (7)	○	○	○	○	○
Pursue Perfection (8)	○	○	○	○	○
5S (9)	○	○	○	○	○
8 Wastes (10)	○	○	○	○	○
Variation (11)	○	○	○	○	○

Feedback (12)	○	○	○	○	○
Last Planner System (13)	○	○	○	○	○
Takt Planning (14)	○	○	○	○	○
Other (15)	○	○	○	○	○

Q7 Which lean principles or tools do you struggle with the most? Select all that apply.

- ☐ Define Value (1)
- ☐ PDCA (2)
- ☐ Pull Planning (3)
- ☐ Map Value Stream (4)
- ☐ Create Flow (5)
- ☐ Respect for People (6)
- ☐ Establish Pull (7)
- ☐ Pursue Perfection (8)
- ☐ 5S (9)
- ☐ 8 Wastes (10)
- ☐ Variation (11)
- ☐ Feedback (12)
- ☐ Last Planner System (13)
- ☐ Takt Planning (14)
- ☐ Other (15) _____

Q8 How would you define lean construction in your own words?

_____

Q9 How well does your organization do the following items:

	1=Terrible (1)	2=Not good (2)	3=Ok (3)	4=Good (4)	5=Great (5)
Pause and reflect to make adjustments to operations (1)	○	○	○	○	○
Keep a clean and organized project site (2)	○	○	○	○	○
Have a process easily identified for the trade worker to understand (3)	○	○	○	○	○
Improve from day to day (4)	○	○	○	○	○
Empower everyone to speak up (5)	○	○	○	○	○
Engage the trade workers minds (6)	○	○	○	○	○
Establish trade flow on projects (the way trades will flow through the work on a jobsite) (7)	○	○	○	○	○

Establish logistical flow on projects (the way equipment and materials move around the jobsite) (8)	○	○	○	○	○
Establish work flow on projects (the way work will be completed in a specific area of the job site) (9)	○	○	○	○	○
Establish clear production goals visually (10)	○	○	○	○	○

Q10 Have you been involved with a construction project that attempted to implement lean principles?

- ○ Yes (1)
- ○ No (3)
- ○ Other (4) _____

Skip To: Q15 If Q10 = No

Q11 How successful do you believe the initial implementation of lean principles on your construction project was? (1=Not successful at all, 5=Highest degree of success)

	1=No success at all (1)	2=A little success (2)	3=Neutral (3)	4=Successful but room for improvement (4)	5=Highest degree of success (5)
Rating (1)	○	○	○	○	○

Q12 What makes the implementation of lean principles on your construction project succeed during the first attempt?

_____

Q13 What makes the implementation of lean principles on your construction project fail during the first attempt?

_____

Q14 Did the project team engage the trade partners effectively on the first implementation of lean principles on your construction project. (1=Not at all, 5=All the time)

	1=Not at all (1)	2=A little bit (2)	3=Neutral (3)	4=Sometimes (4)	5=All the time (5)
Rating (1)	○	○	○	○	○

Q15 Please rate the following statements, indicating your perception of barriers to initial implementation of lean principles on construction projects within your company.

	Strongly Disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Lack of management commitment to lean principles. (1)	○	○	○	○	○
Insufficient training and education on lean principles (2)	○	○	○	○	○
Resistance to change among project personnel (3)	○	○	○	○	○
Inadequate communication and collaboration among project team (4)	○	○	○	○	○
Lack of clear performance metrics related to lean (5)	○	○	○	○	○
Budget constraints hindering the implementation of lean principles (6)	○	○	○	○	○
Schedule constraints hindering lean implementation (7)	○	○	○	○	○

Ineffective lean tools or techniques for the project (8)	○	○	○	○	○
Lack of understanding of lean principles among project team (9)	○	○	○	○	○
Inadequate support from trade partners or suppliers (10)	○	○	○	○	○
Unforeseen external factors affecting lean implementation (weather, regulatory changes, etc.) (11)	○	○	○	○	○
Other (12)	○	○	○	○	○
Other (13)	○	○	○	○	○

Q16 The construction industry has a clear understanding of what using lean principles on a construction site entails?

	1=Strong Disagree (1)	2 =Disagree (2)	3=Neither agree or disagree (3)	4=Agree (4)	5=Strongly Agree (5)
Rating (1)	○	○	○	○	○

Q17 In your opinion, how effective is the construction industry currently implementing lean principles on construction projects? (1=Not effective at all, 5=Extremely Effective)

	Not effective at all (11)	Slightly effective (12)	Moderately effective (13)	Very effective (14)	Extremely effective (15)
Rating (1)	○	○	○	○	○

Q18 Select the definition of failure that comes to you after hearing this statement, "failure to implement lean principles on a construction project for the first attempt."

- ○ Project going beyond schedule (4)
- ○ Giving Up on Lean principles (5)
- ○ Experiencing resistance (6)
- ○ Not achieving buy in from Team (Trades, GC, Architect, Owner, Vendor, etc.) (7)
- ○ Project going above budget (8)
- ○ The project team did not improve (9)
- ○ Other (10) _____

Q19 How optimistic are you about the success of future lean construction implementation attempts based on the lessons learned from the first attempt failures to improve project outcomes? (1=Not Optimistic at All, 5= Very Optimistic)

	1=Not Optimistic at All (1)	2=Not optimistic (2)	3=Neutral (3)	4=Slightly Optimistic (4)	5=Very Optimistic (5)
Rating (1)	○	○	○	○	○

Q20 Please rate your level of agreement with this statement: "Addressing the root causes of lean construction implementation failures during initial implementation can positively

influence the industry's perception of lean construction?" (1=Strongly Disagree, 5=Strongly Agree)

	1=Strongly Disagree (1)	2=Disagree (2)	3=Neutral (3)	4=Agree (4)	5=Strongly Agree (5)
Rating (1)	○	○	○	○	○

Q21 Rank these 11 factors that contribute to the success of lean construction implementation on the first attempt. Please drag them into the order you are ranking them with 1=Most Important and 11=Least Important.

_____ Project Team Commitment (1)
_____ Leadership Support & Buy In (2)
_____ Project Team Discipline (3)
_____ Child like wonder (4)
_____ Team Trust (5)
_____ Need a problem to solve (6)
_____ A lean champion (7)
_____ Respect for People (8)
_____ Visual Communication (9)
_____ Measured Accountability (10)
_____ Other (Please specify) (11)

Q22 Please provide your email address if you are interested in following up with the results of this research.

_____

Q23 Do you have any additional comments or suggestions related to first attempt lean construction failures and/or their implications on the industry's perception of lean construction?

APPENDIX B

Interview with Participant #1

Participant #1

Researcher: [00:00:00] I'm just going to ask you a bunch of questions. When you say mercy, I'll stop. Uh, I'm just looking for honest from your heart answers, which I know you'll give me. Um, it is being used for research. I do plan to publish a paper. Um, I will likely, if it's okay with you, use your name. Again, I'll let you read it before I publish anything.

Researcher: Um, yeah, that's pretty much the basis of it. These questions have been reviewed by my committee. My committee consists of Dr. Shyma Clark. She is my advisor. Uh, and then I have Dr. Sharma, Vivek Sharma, um, Dr. Jason Lucas and Dr. Colin Milburn. Oh,

Participant #1: yeah. Okay. Yeah.

Researcher: Colin has been the most helpful so far. Um, and yeah.

Researcher: What was [00:01:00] that?

Participant #1: I'm just cold. Yeah, my house is cold.

Researcher: You're back in the trades, baby. Um, okay. Again, thank you for doing this. Uh, it should be pretty easy on you. I think

Participant #1: so. Just prospect, I guess, frame it up on just. I know the topic, so just review the topic for me and then, like, my perspective, what company wise organizational wise, industry wide, my experience, like, what, where do I need to lean in?

Researcher: So, the working title right now is unveiling the root causes. Of lean construction failures and initial implementation and their impact on the industry's perception of lean construction.

Participant #1: Okay,

Researcher: I'm looking for you. Um, really from your company's perspective, but anything you have to add, given that you're like, a [00:02:00] celebrity would be very much appreciated.

Participant #1: Okay.

Researcher: Oh, there's Dr. Clark right there. I didn't know she would join here. Let me put her on here and make sure she's good. Hello, Dr. Clark.

Advisor: Hey, how are you?

Researcher: I'm very well. How about you?

Advisor: Well, doing well.

Researcher: Well, uh, I'd like to introduce you to Ms. Jennifer Lacey. Jen, this is Dr. Clark.

Participant #1: I think I met her when we were at, um, at Clemson.

Participant #1: Okay.

Researcher: Awesome. Awesome. Awesome. Awesome. Well, I didn't realize you were going to be on Dr. Clark. Um, so I went ahead and started. I kind of gave Jen the rundown of what the project is, what I'm after, um, and let her know it will be published, uh, likely with her name, given she's okay with that. So, and

Participant #1: so it just like, and I just want to be clear, because again, I'm going to do the same answers either way, but My answers it just shows that I contributed it won't be like Jennifer said this [00:03:00] or

Researcher: I don't know yet.

Participant #1: Okay. No

Advisor: No, it's going to be totally confidential. Your name will not appear on any published Within the body, unless yeah,

Participant #1: and that literally, it wouldn't change anything. I say, I just want to make sure I'm I know, but again, I'm going to give you the same answers either way. So you're fine. No,

Advisor: that's part of what we.

Advisor: Make sure we want to assure that it's confidential unless, of course, you give us permission and we would have to have it in writing. That you are fine with your name being published. Okay. I'm glad otherwise, otherwise, what he's going to do, uh, in terms of writing is he's going to say he interviewed a practitioner with give your background without putting your name attached to it.

Advisor: Okay, X number of experience [00:04:00] in this area. Um, here are the positions have very general. Good.

Researcher: I was going to call her out name specifically, but I guess I'll let her slide.

Advisor: Now, unless you give us a permission and we need written permission to do that.

Participant #1: Okay. We can tackle that after the fact.

Researcher: Awesome. I'm glad I invited you.

Researcher: Anything else she might should know before we get going, Dr. Clark or anything?

Advisor: No, you know, whatever this is again, um, Your responses will remain confidential. So however much you're comfortable with answering, please do so. And if you're not, just that's okay, too. Okay,

Researcher: awesome. So I'm going to take you off the stage.

Researcher: Dr Clark, if you want to re add yourself, you can just hitting that blue button. If you highlight of your.[00:05:00]

Researcher: Okay, hello, miss Jennifer. How are you?

Participant #1: I'm good.

Researcher: Good. I'm super excited for this. Um, can you please provide me an overview. Of your experience and background while implementing lean construction principles on construction projects.

Participant #1: Well, I will try so my current title is lean practice leader. Within Robins Morton, which is the firm I work for, I've been in this role for a little over 4 and a half

years and, um, I guess what I currently do is help our organizational transformation and our implementation of lean practices, but also very much focused on the people part of that implementation and how, how we marry the processes and tools with.

Participant #1: Making sure we're creating the right culture and environment. Um, my experience probably goes back I'd say, [00:06:00] close to 10 years on just how Robbins and Morton rolled out lean and some IPD projects early on, and then starting to see contractually how lean is implemented. And then some more IPD projects that were really focused on culture.

Participant #1: And from that, we've kind of. Um, internally did some brainstorming and some think tanks and things like that and realize that, um, this was something we wanted to do across the board, whether we had a contractual obligation or not. And so, from that point forward, probably 8 years into that journey right now as a firm.

Participant #1: Um, really focusing on that culture of, uh, you know, making sure we're focusing on the people part 1st, and then the tools and processes that go along with lean implementation. Um, and so did that 3 and a half years for almost 4 years prior to becoming. That being my full time role within the firm.

Researcher: [00:07:00] Gotcha.

Researcher: That was awesome. Thank you. Um, and how long have you been in the industry?

Participant #1: Um, 20 years next week.

Researcher: Nice. Congratulations. That's a big, a big number. If I remember right, uh, you were in marketing when you first joined the industry.

Participant #1: Um, I actually wore about 5 or 6 different hats and then I moved. So I wore a pre construction, helped with pre construction help with project support, um, internal office stuff, which was a marketing BD, how we were growing kind of the office that we, uh, just opened in our Texas market.

Participant #1: And so I got to wear a lot of hats early on, which was good because I was coming into the construction industry with no background. And so I got to do a, understand all the project kind of support piece, precon, support how those things interacted with each other. And then the marketing piece, which was the procurement of.

Participant #1: Work and [00:08:00] so I got to where all those has early and then really focused on the BD and marketing piece from that experience. And then that got me connected into our project teams and the ones that were really focused on lean. And once that I got to sit in some rooms and watch and experience those conversations and things that were happening.

Participant #1: I think that kind of lit a fire inside me, and that's probably is where my focus has been, um, again, 8 years, almost, almost 9 years, and then full time, 4 and a half years.

Researcher: Love it. Thank you. Uh, you mentioned Robins and Morton is the name of the company. Can you just give us a brief overview of who Robins and

Participant #1: Morton is?

Participant #1: Yes, founded in 1946, so almost 80 years. We've been in the business, um, probably 30, 40. I'm going to say at least 30 years, really with an intentional health care focus. So, uh, we have in [00:09:00] the last 20 years quadrupled in size. And in the last 8 years, which happens to coincide with our lean implementation journey, we have increased revenue by 80%.

Participant #1: And so, uh, probably 90 percent currently of our work is health care, which, um, is for us a huge and significant because we compete against a lot of really big firms that have a lot of different divisions and health care happens to be 1 of them. And we just don't have the division because that is what our company does.

Researcher: You said 10 years revenues increased by 90 percent

Participant #1: in the last. Well, since let me think. So it's almost 9 years. So, when we rolled out building for it, I'm sure there was some other things that played into that. But in the last 9 years, it has increased 80%.

Researcher: 80 percent

Participant #1: 80 percent revenue.

Researcher: What is your total revenue?

Researcher: Can I ask that?

Participant #1: Um, I [00:10:00] have that number. I don't, I can get it for you, but I don't, I don't think I have it right now to 7Billion or something like that. 1. 27Billion. I believe.

Researcher: Okay, um,

Participant #1: close to that.

Researcher: So you've kind of alluded to this already, but I'm looking for just a quick overview of your company's lean journey.

Researcher: You mentioned 10, 8 to 10 years ago. You started

Participant #1: so we, we rolled it out as building forward. That's what we call it. But it is really, uh, 8 or 10 years ago, intentionally focused on. How do we, uh. Create the right culture and implement the right tools that are going to help us connect with the right partners. And, um, I think for us, it was really being intentional on what clients we were going to work for, what trade partners we were going to partner with to make sure that we can work with them over and over and not just have these 1 off jobs and 1, you know, 1 off places that we were going to go partner with people.

Participant #1: And what we [00:11:00] learned from that, and through that is by, uh, Creating the right environment and partnering with the right people. We have, we have people that want to work for us and choose to work for us and in the environment that we're in right now, where workforce is hard sometimes to get to and trying to get trade, you know, get 2 or 3 numbers and all these things.

Participant #1: When you're trying to bid a job, go through trying to get people that are going to go in locations that are not maybe somewhere they usually go by kind of really. Creating those partnerships, but also creating the environment where they want to work and they want to be in it because they know we take care of them.

Participant #1: It has been where we haven't had to run into a lot of the issues that the industry has run into.

Researcher: Beautiful. Uh, yeah, I think you nailed it. You actually brought, you kind of steered me right to the next question, which

Participant #1: is,

Researcher: uh, will you, will you please share some examples of lean culture in your organization and how they were developed? [00:12:00]

Participant #1: Um, yes, so I guess I can just start from the beginning. So every new hire that comes into our firm.

Participant #1: Goes through and spends a day with me. And so, okay, what is that different than anywhere else? Well, because my entire focus is our lean implementation and our culture of caring about people. And for me, that's those 2 things go hand in hand when it comes to lean implementation. And so every new hire that comes into our firm.

Participant #1: Goes through a class to understand that Robins and Martin, this is how we do business. This is not a department over here, a division over here, an initiative over here that you can choose to building to be part of building for it or not. Like, building for it is how we do business, which is we make sure that we focus on every person touched by the project and that we are putting them 1st.

Participant #1: And then we are worried about, okay, what tools and processes and things like that. So it's not our lean initiative, which is very important to clarify. It is our [00:13:00] initiative that incorporates lean practices because we want to make sure that we don't lead when we lead with lean at the beginning. Um, and you know, before we kind of repurposed it and realized what we needed to do when we led with lean and what lean was and the tools and processes it, the resistance in the walls went up.

Participant #1: But now that we lead with people and the culture and the environment, and that lean practices are part of that, it completely changed the way people approached it.

Participant #1: Wow. That's 1 example. Sorry, that's the new hires. And so, Uh, when new hours come in, that is part of it's just it's required and it's because we want to make sure they understand how important this is. And it's not just me in there. But our CEO comes in and he speaks to where we came from. Why? This is important.

Participant #1: Why they're here today and why you're here today. And why and why this is how we do business. The other part is across our company. Um, since I've been in my [00:14:00] position, and I track it, and I measure it. Every 1 of our projects across the board, and I'm going to say, currently, we are tracking a little over 100 projects about almost 70 project teams, because some campuses have multiple projects going on.

Participant #1: Every 1 of them go through a process where 1 of them is an internal alignment meeting and that internal alignment meeting, they go through the culture and

the environment that's expected. What tools and processes they're going to commit to implement on the job. And then, as a team, who's championing those, what do those look like for that job?

Participant #1: And that really kicks off kind of the process of where I get to get engaged and help them, whether it's alignments, trade partner on boardings, but also setting the, I guess, the bar of what tools they want, where they want to what tools they want to implement. And then I get to then hold them accountable to that, to that measurement.

Participant #1: I think those are 2 examples. Maybe

Researcher: those are beautiful. The 1st, 1, I really, really like, [00:15:00] especially with the learning that you gave to us. Thank you for that.

Researcher: So, I guess this question is kind of assuming you've seen lean construction fail on a project before. Um, how often have you seen lean construction fail?

Participant #1: Um, I saw it a lot early on in our journey because, uh, multi and there were, I guess, two big reasons. I think the way that I saw it was number one is the way that the company rolled it out.

Participant #1: So that was, uh, the way they rolled it out is we had some very successful IPD projects. And they thought this is a better way to build. It's a better way to do things and approach things. And we decided as a company, we were going to take that mentality and all that, all those processes and things and create a manual that we would roll out to all of our projects and tell them we're going to build a new way because it's better.

Participant #1: But without the contract, [00:16:00] and somehow we thought that was going to make us better. And all it did is create resistors and people going, you've lost your mind because I've been successful and I've been building for a long time. And how how do, you know, this is going to make me back. So. Number 1 doing lean to somebody.

Participant #1: Which is that was our 1st fail and then the 2nd 1 was when things went sideways on a job that was 100 percent bought into lean. Well, somehow I think we, I don't know why in construction, because it's titled a lean project. They're just not allowed to have constraints and failures and things go wrong. I don't even know why, but for whatever reason, it's a lean job and you do, you have a better culture.

Participant #1: You're doing, you're implementing things that are going to make you better. And then things go sideways. Oh, it's because it's. It's a lean job. It's because it's that lean stuff that you said was going to work. And it does it and see, see, see what's [00:17:00] happening right there. Like, to me, that was the other type as they were using it when it was convenient as the reason why something failed.

Participant #1: When some of those people were doing things for the first time, sometimes they were trying to roll out new things, but it was an easy way for people to, to, to point out as the reason why it didn't work.

Researcher: Thank you. All right. So the next few questions are designed to better understand the reasons for failure. Um, I guess the 1st question is, how would you define a lean construction failure

Participant #1: where it's being used as a weapon? To a failure [00:18:00] that is turned around and used to attack somebody, or used to a weapon to diminish someone's efforts or to, um, to, I guess, um. Trying to think the right word it's when it's weaponized. Sorry.

Researcher: You're talking about Lincoln when lean is weaponized.

Participant #1: Yes. That's to me, when a failure is weaponized when a lean when a lean failure is weaponized.

Participant #1: That is when we've taken something that maybe there was good intention. And and how it was rolled out, but if you're, if you're rolling out last planner or constraint board. And there's a fail on it. And you're using the fail to turn around and treat someone like you would in not in a non lean environment, then you then, like, it's a, it's a lean failure because you're not even [00:19:00] using it in the right context.

Participant #1: And not using it in the right environment for what you said you were going to do.

Researcher: How do, you know, when the tool fails,

Participant #1: I'm not going to say a tool ever fails.

Researcher: Okay,

Participant #1: because there's not a tool out there that a human being doesn't have to be a part of it. And if the human, if the, if the tool implementation did not meet the

expectation, then I'm going to say 100 percent of the time 99. 9 percent of the time, it was either the learning or the coaching or the training or the.

Participant #1: Communication of the expectation.

Researcher: Okay. So I guess I'm still struggling with how you define a lean construction failure. You said when lean fit when lean failures are weaponized

Participant #1: construction fail. Let me think. Okay. Let me make sure I'm clear [00:20:00] on how I'm saying this. A lean construction fail

Participant #1: is. Manipulating the situation to try to say it using lean. As to get buy in to only to for the, for the sole purpose of weaponizing it.

Participant #1: So we want you to open. We want you to share. We want you to be collaborative. We want you to give us your thoughts and your feedback. We want you to really tell us what's real here on this board and how many people you're going to be on here. And we understand it's not always going to be accurate and 100%, but we want you, we want to create this environment to where you can tell us the truth.

Participant #1: And then turn around and manipulate them to do it and then turn around and now they can charge them extra. They can leverage that data to be able to attack them and weapon up. [00:21:00]

Researcher: Gotcha. Okay. Thank you. All right. How do you measure the success of lean construction within your organization?

Participant #1: Very easily. So there's a couple of things for me.

Participant #1: Number 1 is leadership buy in. That's that's number 1. so I can, I got, I can have our leaders are at the top of our company. Say, this is how we do business, but if I don't have every single. Operation manager, a person that that manages people and offices and things, not if they're not bought in, then to me, that's a measurement because you could talk it all day.

Participant #1: But if the action doesn't follow through, then then that's an easy 1 for me. And so, because we've been doing it, and I can measure measure it just from that degree to the next degree of how our projects are implementing it. So. It's an expectation that every project across the board sits down and does an alignment meeting and they pick the tools they're going to implement.

Participant #1: They give [00:22:00] that information to me. And then every month, they have to do an assessment internally that tracks against what they, the. The bar that are the expectation that they set their alignment and so I get all of that data and so it could be crap data, but it's not just yes. No, it's levels of implementation.

Participant #1: There are clearly defined definitions of what that looks like. Um, whether it's a 1 to 5, and we've defined what those look like, but it's not 1 person sitting in a room going. Let me just check these boxes real fast. They actually sit down as a team in a monthly meeting and assess as a team where they are against the, um, you know, the levels of implementation based on the tools that they committed to.

Participant #1: I have all that data, and so it is visualized in power, and it is shared not only to our leaders, but back to our teams. So that they can see where they were before, where they are against other teams in the company.

Researcher: Those are based on their own [00:23:00] commitments

Participant #1: based on their own commitments and their own self evaluation. And then within the self evaluation, there are 2 triggers that kind of get me engaged. Number 1 is, if it's a 1 or 2. Then it triggers me that to reach out to them, if they need support or coaching, or kind of another layer of maybe something that they're that they're needing to be able to jump up to the next, um, you know, to the next level.

Participant #1: And then, if it's a 4 or 5, which is more of a innovative industry, leading type response, it's another trigger for me to reach out to go. Are you at a place where people can come learn from you? And also, are you what you're saying? You're doing? Are you doing?

Researcher: I love how you look at it from both sides. Yes. What are the most common reasons why lean construction fails on the first implementation within your firm?

Participant #1: Because[00:24:00]

Participant #1: we forget, we forget the PDSA process. We forget that when you do something for the first time, there's a really good chance that's not going to be how it ends up. And so we do something, and then I rolled this out and I told people to come to the meeting and we had them tell us what they were going to do, and they were making their commitments and then they didn't meet their commitments.

Participant #1: So, like, you're saying this is going to make things more transparent. They're going to make people more collaborative and it, like, it didn't work. And so it's,

it's the expectation that, which is not the expectation anywhere else in the world that you do something for the 1st time. And it's going to be amazing.

Participant #1: But for me, that is where. It's been easy for people to jump on that and go, see, you said it was lean. You said we did if we rolled this out and we did this, and this is what would happen and it's not happening. So, see, it's not, you know, it's not it's not what you say it is, or it's not it's not, you know, [00:25:00] there's this team failed to do it.

Participant #1: If they're trying it for the 1st time, and they're doing things they've never done before. Like, I don't know how any part of that can be defined as a failure, but if it's not giving the expectation of someone coming in that may be uncommunicated expectations or expectations that are just unrealistic.

Participant #1: But they can use, they can say the failure was because they didn't meet my expectations. And in my mind, if you're going in with with expectations for people that are just starting lean, they need to be so clear. And if they are very tactical and very, um, comprehensive expectations. You're going to struggle if they've never done it before, because a lot of lean is subjective.

Participant #1: A lot of lean is things that sometimes it's, it's not a very black and white response. Now, the tools and some of those are very easy to do that with, but there's a lot of lean. That's not.

Researcher: Amen sister, [00:26:00] so can you share some examples of lean tools or techniques that have been successful. And improving project performance, reducing waste when implemented on lean projects for the 1st time.

Participant #1: Um, an easy 1 for us, I'm going to say for me, but the easiest 1 for me is, uh, that I've seen over and over and over again as conditions of satisfaction. I mean, it's an easy default 1 for me, but when you get clear expectations early, and it's not just clear expectations from 1 party. But every party that's involved, and those that are making decisions throughout the project, and those that have to.

Participant #1: We'll have some accountability that maybe they're not used to when you can roll out and have the conversation around conditions of satisfaction early and ask them. Hey, what does success look like? And what's important to you on this project and they start being able to define that it to me all of a sudden it's their words and you are saying, okay, this is what you're saying.

Participant #1: And we're going to hold the whole team [00:27:00] accountable to these things. And if we do all these things and everyone's yeah, we're good. We're bought in on this. If we do all these things that are up here. We're Then, at the end, there's no reason why all of us won't say this was an amazing job when you put it that way.

Participant #1: And they have to, like, I mean, like, you're, you're kind of put creating the accountability early before they ever get caught. And then later on throughout the project, because you've set these kind of rules in place, these standards in place when decisions have to be made when, you know, when, when. Promises aren't met all of a sudden.

Participant #1: It's not I'm me against you. It's hey, we had we all agreed on this. And if we were going to be able to get to the end, like, right now, we're getting off course. How do we get back on? It's an easy conversation because it doesn't make it about you were wrong. And I'm right. It makes it more of a team conversation on.

Participant #1: Hey, we want to get there together. And we agreed this is what it's going to take. So how can we get back on track?[00:28:00]

Researcher: I like it. Are there any other tools you'd like to highlight that are like super helpful when implementing the first time?

Participant #1: Let me think. Well, I mean, visual communication, visual management. If that's a big 1 and you're like, okay, what does that mean for us? It's it's it's full transparency. The more that you can put out on dashboards on screens on anything you have out there to where anybody that walks on the job from the client to the designer to the engineer to the, I mean, it doesn't matter.

Participant #1: The inspector. Anybody can come anytime and look and see what's happening on your project. Um, we, I mean, for us, it's our boards, it's our constraint log, it's our safety materials, you know, delivery, everything we can do, the more we can make it visual, the more, in our opinion, like, there's nothing, you're not hiding behind something, like, we have, we've had jobs that have had boards that are like, we've submitted the, the, um, pay request to [00:29:00] the owner, the owner has signed it, it is now waiting for this, before it goes to the bank, I mean, when you got trades going, where's my money?

Participant #1: And they can walk into the trailer and they can see, you know, where it is. That doesn't mean they still don't want their money, but it's very easy to be able to like mitigate some things that normally are really big issues. What, when you just put everything out there,

Researcher: What a cool example. That was, that was really neat.

Researcher: Thank you. Um, who do you engage or involve in the implementation of lean construction on the,

Participant #1: um, it starts with the leader. Like, the executive leader, like, we, I, it always starts with them and, um, and then for us, it's on the job site. The lead, the executive leader of the, our operations manager is always engaged and then our manager in charge, which for us is superintendent level.

Participant #1: Um, and then that, [00:30:00] I guess that's who I engage with 1st, but every single person, every single Robins and Martin employee that is on that job is required to be in the. Internal alignment meeting, like, they're not if, like, if they're not there, we'll reschedule it. So every internal person has to be there for the kickoff.

Participant #1: And the commitments, and then we engage the owner and the designer and the alignment meeting, and then we'll do the trade partner onboarding to make sure they know the expectations.

Researcher: Got it. How about frontline workers? Those

Participant #1: are okay. So once we've on boarded our trades, which would be our major trades early at the beginning.

Participant #1: We, those would usually be executive level just to make sure we got buy in on what our expectations are going to be on site. Okay. Normally [00:31:00] superintendent form and level, it will be, uh, in that initial meeting. And then, as we go from there, our quality at the source program and a lot of our, um, last planner, our boards are planning, you know, at the source piece, all of those.

Participant #1: Engage. Every person from the trade, so our client, the source, when we do when we do meetings for, um, kind of creating the checklist and what those look like for each of our scopes of work, like, it's not just 1 person in that room. It's that entire trade in the room walking through what that looks like.

Researcher: That was cool. So, you mentioned experiencing resistance. Did that ever happen on the initial implementation of lean construction?

Participant #1: Resistance? Oh, a lot. Yeah, I think I mean, I think when we, we realized you can't roll [00:32:00] out lean implementation. Across an entire organization, I think everyone's just going to start getting in line and going.

Participant #1: This is the, this is the best thing since Christmas morning. Like, what we realized early on that we got, we got a group of people that were self identified and also identified through their lead through their managers probably started out with a group of 30 people that were forward thinking outside the box, willing, willing to kind of, um, try some new things, like, identified a group of people.

Participant #1: That could help us, what does this look like? If we're going to do this organically, and we're going to do this across our company, it's not going to be overnight and it's not going to be starting with every project. And so we identified a group of people to help lead it and we identified at that point, probably 7 to 8 pilot projects across the company with a lot of those people on those jobs.

Participant #1: And, um, and then we started. Starting those jobs with [00:33:00] lean, and that was 8 or 9 years ago. And now those 8 8 jobs that probably had some young people on them, but also had some leaders on them that were willing to do it. And then within construction, as soon as those jobs finished, those people went to other jobs, and then those people went to other jobs.

Participant #1: And so, over the last 7 or 8 years. Young guys that maybe we're coming out of college or field engineers or project engineers are now running their own work. They started that way. And so now organically, it's happening across our company. And I just had a conversation 2 weeks ago and we were talking through, like, because resistors is always part of our conversation resistance and people at a superintendent type level.

Participant #1: If they're resisting, it's hard for us because we have people that have grown up in this culture. And now they're under someone who maybe is not promoting it. And every time it's like, okay, Jennifer, like, okay, like, how do we, how do we work with how do we deal with that? And I said, I'm going to tell y'all, like, [00:34:00] y'all think it's this big number.

Participant #1: There's less than a handful of people in our company. That are at a level where they are resisting what we're doing, like, 2 and we probably have 2 more that aren't as much bought in, but they're not standing in the way. And sometimes they revert back, but they're still allowing their teams to do the things they need to.

Participant #1: Out of our every project we have, and to me, like, it's where, from where it started to where we are now, it is absolutely attributed to organic growth and our people that are now 7 or 8 years into this, some of them, this is all they know how to do. So how do you overcome resistance to lean implementation when it is all they know, how can they resist

Researcher: it when it's all, you know, there's nothing to resist.

Participant #1: I mean, I mean, it [00:35:00] seems easy and I mean, and it can't be Robinson. Morton's going to be lean next year. There's I mean, it just can't be that way, but if we made a decision 8 years ago that this is the direction of our company. And now. People that were coming in and excited and learning it.

Participant #1: And there were people that were this is right up their alley. Eight years later, these are our leaders that are running work right now. Like it's easy for me.

Researcher: Um, I love it. And this like, this is, I think people would pay serious money for this conversation. Well, you

Participant #1: haven't recorded, so I gotta be careful.

Researcher: Oh, yeah, I would never do that to you.

Participant #1: I'm just messing with you.

Researcher: It would break my code. I'm

Participant #1: saying on here that I, I absolutely haven't said somewhere else or that, You know, it's, it's, this is just what it is.

Researcher: I'm just saying people would be very much entertained by just [00:36:00] this conversation alone. I think, um,

Participant #1: it sounds like an abstract for something.

Researcher: Yeah. Okay. Uh, can you please share Any innovative approaches or technologies that you have used to support 1st attempt lane construction limitation.

Participant #1: Yes, I can. And so it's and you're probably looking for specific things, but this is going to be more of a mindset. So we just highlighted last month and in our monthly building forward spotlight call our VDC and our BIM efforts. And so you're like, okay, that's great. Like, BDC and BIM are not innovative.

Participant #1: Well, 1 of the things we highlighted was we have a technology. Implementation coordinator, and what does that mean? That for her role in our company is when I get an email from a cool technology that I think is really [00:37:00] cool. And I think it would be really good for our jobs. It goes to her, she vets it out.

Participant #1: She does some research. She finds projects that are willing to beta test it. And then they get to give feedback, and then she gets to compare it to other projects that are doing beta testing. And then they get to make a very. accurate, honest, you know, I guess, you know, feedback, a review of what that is.

Participant #1: Inside of a, it's like, it's, it's like, we get to have these, this Petri dish of a company and a company that is willing to vet these things out. Not just, hey, it doesn't meet the cost model or, hey, it's not doing these things. And we already have something doing it. But that innovative. Mindset inside our company.

Participant #1: It's we've got projects that have tried something, tried another one. This one didn't work. This one's not ready. We had one that they just rolled out. They to try and the, the, the [00:38:00] developers from like Europe, uh, sorry, my screen just went out and let me get this just to say, I didn't use my mouse enough. Um,

Researcher: I can still see you.

Participant #1: It just blacks out. Uh, but the developers from Europe came over and sat in a room with our people. To kind of vet through things that weren't working same thing that happened with us early on with Procore like, I know Procore now is across the country, but we were early engaged with Procore when they weren't what they were and their developers came and met with our teams and started vetting out.

Participant #1: What needs to be there? What is it? And again, so we've been on Procore has been part of our jobs for 7 or 8 years. Even though in the industry, I mean, they're blowing up because of everything they're touching, but we were able to be a part of that early. Kind of helping lead the way on things that need to go, but it's not just that it's every little thing when our people come up with an idea, or, you know, they're able to to really use, use, [00:39:00] use our company as a way to.

Participant #1: Yeah. You know, we have a, the little, the robotic dog that goes around and scans things and we have, um, what is it, the autopilot, you know, things that can, you know, their self. The modular, I mean, there's, there's all these little technology things that it's not. Oh, no, we're not going to do that. Or we're just going to try everything and we believe everything's great, but it's like, how we vet things out.

Participant #1: It's encouraged. And there's a lot of times where it's like, this is not ready yet. They promote it and they say it, but it's not ready yet. So there's that aspect of just the, I'm going to say the entrepreneur. You know, kind of, you know, environment of let's, let's try and see what can work. And then the other piece that I think is huge.

Participant #1: When it comes to innovation is, um, our innovation lab and so you're like, okay, what does that mean? So Steve more leads that and the coolest thing about it is it is a lab that pretty much if you have a [00:40:00] problem and issue anything that you're running into that. It's an industry problem. It's a Robinson Morton problem.

Participant #1: It's a project specific problem. And you're, you think that, hey, I think there's a better way to do this. You get him engaged and you start going through and he's, he's kind of helping work through how do we design something better? How do we define, define something more efficient? How do we eliminate waste?

Participant #1: How do we make this safer? And so together we're actually presenting on this at Congress, this year, but it's how do we create things? That are going to revolutionize our industry, and he's going to, we're going to talk through 2 or 3 of those. And 1 is a cord clip that you can use to be able to put a drywall to put in framing and you can get cords off the floor in 1 of our, he worked with 1 and they try different models.

Participant #1: They try different things. And how do you do it? You know, when we have things roughed in when we don't all this stuff. Another 1 is when you're testing fire dampers. Like [00:41:00] you gotta be careful because there's that can like snap, snap. Yeah. And so he's got this device that it is literally, and they're still in the process of like, where he can put it in and it automatically does this thing with no hands in there.

Participant #1: But like, these are cool innovations that are happening inside our company. And so it's like, Oh, this little secret lab, but it's encouraged, like anybody that has a problem or an issue. They can just start this conversation and we are creating things inside our company that then get shared across all our projects.

Participant #1: And then we get to talk about them and the, until the industry, how there's a better way to do things.

Researcher: Brilliant. A lot of that. So, uh, okay. One of my favorite questions, what advice or recommendations would you give to organizations looking to implement lean construction for the first time? [00:42:00]

Participant #1: I would my very, I guess the most important thing is you need people that want to do it. And so I would start with, like, where do you want to be with an as an organization?

Participant #1: You know, what are your goals? What is your mission? What are your values? And then, if those align with the things that that lean support, and that, you know, and that really, you need to be able to create that environment, then you need to find

people that this is, they want to, they want to do this because if you, at any point, try to do lean to people, it will fail.

Participant #1: And so you need people that are that literally will say, because I want to. And I want to try this because I'm like, I'm excited or whatever. As soon as you say, I'm appointing you to this and I'm going to it's your job to make sure that we implement [00:43:00] this, that we do like, whatever, then it's just another thing.

Participant #1: And that's the same as construction's always been. And so, and that that seems very like, okay, but like, how do you measure that? And what does that look like? And how does that help our transform our organization? Because if you don't have that core people group of people, which I told you, that's what we started with 8, 9 years ago, a group of 30 people.

Participant #1: In a company that think outside the box have a growth mindset, you know, kind of that critical thinking. Hey, I think there's a better way and really question things that question the status quo a little bit on. Hey, have we thought about this? Have we thought about this? Not scared to fail those kind of things.

Participant #1: You need people that have that type of mindset. And usually. Sometimes it's the, it's younger ones. Sometimes it's ones that have seen growth and have really embraced things throughout and you kind of need a little bit from every level. So you have to find those people at different levels, but you find a group of people like that.

Participant #1: And [00:44:00] literally they can help your company catch fire.

Researcher: Can you share any experiences where lean construction implementation on the first attempt has resulted in significant cost or schedule improvements? Um,

Participant #1: let me think. Well, I, I mean, I know one of our first IPD jobs that we rolled out. I mean, but it was contractual. So I'm going to say, I'm going to say we beat the schedule significantly, millions of dollars saved, but we were contractually obligated to it. So I don't discount those cause I know that's how we got started.

Participant #1: But I also know when you are contractually obligated to implement lean, it is a different culture. It is a different way to approach how you do it. And those are project specific. So you can, I'm going to say, You can't do lean to people. [00:45:00] Those two, those first projects, those lean was done to us through a contract.

Participant #1: And we did it and we had success and we made money and we beat the schedule and everything that we say lean does because the contract made us do it. And so

I think that you, you need to be careful when you use those measurements. Obviously, people like those tangible things. It's going to save us money.

Participant #1: It's going to make our quality better. Like, all of those things are byproducts of it. And for us, if you, this is the, we have 1 of our leaders that says. If you have great people, you treat them, right? You put them in a great environment. Make sure the culture is good. They're going to do great things.

Participant #1: I know it's hard to measure that. I know it's hard to to put that in analytics and all this stuff. But for us, by doing those things, you're going to get the byproduct of [00:46:00] a better, better quality products, safer project. You're going to beat your schedule or meet it, which is really the goal. It's not to beat it, but it's to meet it and then to spend every penny you can.

Participant #1: To make sure that the owner gets exactly what he wanted. That needs to be the goal yet. Everybody in construction says beat the schedule, beat the budget and you're in your, in your, you're, you're the winner, but it shouldn't be that way.

Researcher: I like it based on your interactions of various project team members.

Researcher: What are their views of lean construction after the initial implementation?

Participant #1: It's hard. It's hard. That's their biggest. Their biggest thing is that it's hard because number 1, most of them, some of them, it's something different. So they're having to learn and do it along the way, but is not the way that a majority of people in construction approach work.

Participant #1: And so it's hard to get trade partners to [00:47:00] buy in. And believe that you're not going to come back and use it against them. Later. It's hard to get buy in from an owner. That is so focused on budget and schedule that they don't realize the importance of the environment and the culture you're creating. And it's hard to get up there and have people.

Participant #1: Open up and make commitments and be honest about manpower, you know, about the workforce, about how much work they're going to commit to do to go into a pool plan and really not try to sandbag and really give accurate information. It's hard. And I mean, to me, that's the biggest one. It doesn't mean they can't do it.

Participant #1: It doesn't mean they don't put the effort in to create the environment, to help people know, Hey, we need you to trust us because we trust you, but it is hard.

Researcher: What do you think the industry's perception of lean construction is?

Participant #1: Cut costs, make money, [00:48:00] shorten the schedule, and then, um, we'll get to be able to get people ready to go to the next job. Like, to me, that is what it is. And the people that, it's funny, like, I have people even within my own firm that Jennifer, you got to be, you got to be careful with those pool plans.

Participant #1: I'm like, okay, tell me what you're talking about. Like, you got to be careful with those pool plans because what happens if you do that pool plan and we should have started 3 months ago. It's better to know now. I mean, like, literally, those are concerns that then the owner is going to think that I was like, okay, 3 months ago.

Participant #1: Maybe, maybe not. Are they ready today? No, but so, I mean, but those are, those are, those are things that people worry about when it comes to, you know, the, they're going to, they're going to want us to have less budget. They're going to have less general conditions less this, because the full plan says we can [00:49:00] do it in this amount of time.

Participant #1: But we said, this amount of time, they're now going to want to cut that time off. I mean, those are, those are real concerns based on when someone sees this. Now, it's a transparent, open, collaborative conversation about real work being put in place, but we made this promise now. This says that we can do it quicker, better, faster, blah, blah, blah, all those things and then that now our expectation is going to be this.

Participant #1: I mean, like, it's just, it's it's comical because like, so you don't want the accurate information. Yeah, I want it, but we want to make sure that we can manipulate it. I'm like, okay.

Researcher: Okay. Um, so that was the first part.

Participant #1: Just the first part.

Researcher: Yeah. What, what questions am I missing? Do you think, or what questions would you add?[00:50:00]

Participant #1: Um, I think one that you didn't ask about was how important is respect for people when it comes to lean success or failure. I

Participant #1: don't think people make that tie. And I, and I, I, I don't know how you can't. Either have, we don't care about people. We need to make sure these tools are getting put in place, or we do care about people, but we know we may struggle with some

other things. Like, I think sometimes people forget the value of the people that are putting the tools and processes in place.

Researcher: Yeah, see, I'm trying to not lead people. Um, how important is respect for people? Okay, so

Participant #1: maybe no, no, no. Okay. Then you're right. You're right. You're right. No, that's a, that's a leading question. So, like, what? Is maybe a factor that plays into lean construction failure or success. [00:51:00]

Researcher: Okay,

Researcher: our factors play into lean construction 1st attempt failure. So, what are some factors that play into the lean construction 1st attempt failures?

Participant #1: I think the biggest 1 is focusing on outcomes. We, we are very visual. And when we walk the job site, we are looking at work being put in place. That is what we look at.

Participant #1: And that defines success. Or failure, and I think we at no point stop and turn a little bit to the right or to the left and look at those hands of the people that are putting the work in place. I

Researcher: like it.

Researcher: Trying to filter [00:52:00] through this since we have 5 minutes here.

Researcher: What are the driving factors or motivations behind the decision to adopt lean construction? Are here, can you describe a specific project or situation where the lean construction principles were initially implemented?

Participant #1: Can you repeat that again?

Researcher: Can you just do is there a specific project that you can think of? So I just want to think of 1 project while I hit you with. 4 or 5 more questions. Um, and really, I'm looking to understand, you know, what does that project look like? Um, and like, what are the main goals of the of lean construction on the project?

Researcher: Um, what were the driving motivators for adopting lean construction? Um, and what if any background was provided to the team on [00:53:00] link construction?

Participant #1: Um, the 1 I'm thinking about, it was again, the expectation from the, from the leaders on the job, like, the ones that were assigned on that job, or some of our highest performing.

Participant #1: Not only just people at our company, but this is the way they do work and it was not a compromise. Like, if the owner was not going to be bought bought in, or the designer wasn't going to be funny, and it was not going to change the tools and processes they were putting in place. It just happens to be that they weren't 100 percent on board early.

Participant #1: And this is a big project. And they just put them in place, and they said, this is what we're going to do. And we're going to do an OAC stand up every day. And if you are here in person, that's great. If you're virtual, that's if that's great too. If you choose not to come, you will still have expectations on the board.

Participant #1: We will still make the commitments for you. And if you don't meet those, Expectations, then you will cause the PPC of the team to to be below 50 percent and they just put these things in place [00:54:00] and there were times where people didn't show up and then they wanted to know why they were on the list and why they things didn't get done, but they started showing up and they started not only showing up, but getting engaged and started questioning and starting making commitments for themselves and then being able to look at that later and realizing that, well, Once they were there, they were making decisions in these meetings that sometimes took weeks before somebody would make a decision to get something done.

Participant #1: They're making them in the meeting. So I think sometimes the biggest. What I've seen where you were late implementation, it's a shift is when you do things. It's almost like, uh, if you build it, then they will come like that mentality. If you create it, even with those that are like, I'm not going to do that.

Participant #1: I'm not going to be a part of that. When you create it, and you start doing things, they're interested. They're curious there. What is this? Why is that up here? Why is that board up there? Why does that information up there? When you start [00:55:00] creating the environment to where all these things are out there and it's only helping, it's only helping the project be better helping the communication, all those things.

Participant #1: When you start doing those things, and sometimes it's small because of the size of the project or their experience, but if you start, we're going to do daily huddles. We're going to make sure we're visual. We're going to make sure we're doing a condition satisfaction, little things that people start asking questions about when they start getting used to it.

Participant #1: We're going to review the conditions of satisfaction at every meeting and all of a sudden, it's somebody else is now leading the conversation and they're asking about this. And I don't think that's right. And you've now got them in a space without going. Come here. Come here. Let me pull you in. Because it's like, they start looking and they start wanting to know what's going on when you can do that and they come in and they're curious and they start asking and then they're swimming in it.

Participant #1: They're like the frog in the boiling pot where they're swimming in and don't even realize what they, where they are and what's happening to them. That's like magic.

Researcher: You're getting me fired up over here. [00:56:00] So, 1 last question, um, uh, looking back, what are the key lessons learned? From failures of the initial lean construction implementation, what changes or improvements would you

Participant #1: recommend?

Participant #1: So, biggest 1 and I, and I say this and anywhere I can, if you are going to implement lean, or you're trying to change your organization, go out and identify and find those top performers, those people that have been killing it and make sure they're part of it. Make sure you may have some rock stars that are that no lean that can do lean, but if you do not engage those seasoned people that have been out there making you money, hitting their budgets, hitting their schedules and having success, and you don't get them engaged and you don't let them know that they're going to be part of the change and they're going to help lead it.

Participant #1: You are going to struggle and it's going to be [00:57:00] harder. You can still do it, but it's going to be harder to turn that ship when you have people trying to sink it.

Researcher: You're awesome.

Researcher: Any other questions I should be asking?

Participant #1: Um, no, I mean, I think you hit everything that I would, that I normally talk about on our, our fails or things that we've struggled with.

Researcher: How was there a lot harder than I thought it would be?

Participant #1: Why?

Researcher: Well, I expected some answers different.

Participant #1: Okay,

Researcher: which is a good thing. I guess that's why I'm doing the research right

Researcher: here. I'm still struggling a little bit with your definition of the lean construction fail. And how, how could I prove that? [00:58:00] How could I prove your scenario? Define a job as a lean construction. That's my struggle there. But again, because right now, I've, I've defined it. I've kind of taken the easy road of.

Researcher: Um, just schedule failure means lean construction didn't work on that job.

Participant #1: Yeah, and I, and I struggle even with calling a fail. Like, I've got a resistor that is resisting and will resist till the end of the world, but he knows he has to put a last planner boards up and he knows he has to do daily huddles and so he is resisting because he does not want to have to do this and he's being made to do it and his coming in ready to attack me.

Participant #1: In a alignment meeting, because and I was prepped, I was told he's going to come in and he's got his freaking gun loaded. So, okay. And his, his resistance in that meeting was, let me tell you why I have a problem with these boards. I said, why is that? He [00:59:00] said, because everything we do with CPM is about milestones.

Participant #1: I said, okay. He said, what if there are there activities that impact milestone, milestone dates and other activities don't and I said, that's a great point. He said, so what you know what I did, I said, what did you do Dave? He said, I put a column on my board on whether it's a milestone activity. I said, that's amazing.

Participant #1: That's not a fail to me, but I mean, like, he's a resistor. He does not want to do the things that he's being made to do different. So he came in to attack my process, but he made the process fucking better. So, I mean, for him, it doesn't mean that all of our, none of our other ones are worried about that because they know all activities impact.

Participant #1: I mean, like, but he, that's where he was. He was so caught up on that. And he, so now he, he marks those differently. That's a great idea. So to me, like, so I struggle with the word bail. If it's, I mean, if you're, if you're, it's to me, the only fails are those organizational big picture, how you are [01:00:00] rolling out and implementing lean to me, that's the only fail because at a job site level, if they're doing, if you're doing a pool plan and you're an organizationally, you are doing it for the right reasons.

Participant #1: And you're rolling these things out because you're really wanting to change. And you go in and the pull plan is a disaster wasn't a fail.

Researcher: Yeah, you got people talking. I mean, I'm saying,

Participant #1: so like, I struggle even your definition. I wouldn't even touch, but it's like, that's so, that's so in the weeds piece of what, that's why for me, a lean construction.

Participant #1: Fail is when it's not the intention is wrong and you're doing it to roll it out to be lean with the sole purpose of being able to weaponize it. Once you get the data that you need.

Researcher: Yeah, well, my, my initial answer to that question was when people don't feel valued on the job. And then the, my advisor was like, well, how are you going to [01:01:00] measure that?

Researcher: And I was like, I don't know, through a survey, like, just ask them if they feel valued and. I wasn't good enough. So I needed something more concrete that defines lean failures.

Participant #1: I'm telling you, if you ask somebody, what is the intention? Why do you want to do lean? What's the answer? That's your, that's your concrete like that.

Participant #1: Like to me, if the intention is not right, why do you want to do lean? Cause I need my jobs to make more money. I need my jobs to make sure they're hitting their schedule. I need to make sure my trades are doing exactly what I tell them to do. Not a good intention.

Researcher: Yeah. Yeah, R. O. I. Right.

Participant #1: So to me, it is the intention, right?

Participant #1: If the intention is right, you're going to screw up. You're going to fail. You're going to things are not going to be right. But to me, that is not a lean implementation failure. That is part of the process. So, what defines lean implementation failure is to me, the intention of what you're trying to do.

Researcher: Hmm.

Researcher: I like that a lot. That was huge. That's [01:02:00] like a one liner that I should pull out in class. Am I going

Participant #1: to get a copy of this video just so I can have it as my own reference? Of

Researcher: course, yeah. I can send you a link. Awesome. What else, Gal?

Participant #1: Nothing, this was easy. I was not that I was worried about it, but I was just like, this is the stuff I don't get to talk a lot about, even though it's like, so part of everything.

Participant #1: And every once in a while, there's 1 or 2 questions like it, but it's just like, this is the magic stuff. This is the stuff. That is not talked about. Cause I was having to go through my damn classes for Congress. And I'm just like, holy, like, like how many more times can we talk about how wonderful and great this journey and this and that, like this right here, this conversation is the stuff that I'm like, this is what people need to hear.

Researcher: Well, good. I hope we have more of them, although nobody is going to hear this because it's just for my research purposes only. Uh, But this is leading [01:03:00] into my dissertation for my Ph. D. where I'm going to help design a system that reinforces lean construction. So, um, I'll likely be hitting you up again for that.

Participant #1: Okay,

Researcher: what else? Yeah, I can send you a copy right after. Um, I want to put this in this to the lean builder team and tell him this is this week's podcast.

Participant #1: I'm fine. I don't care.

Researcher: Yeah, I think people would get a kick out of this conversation. I really do. Uh, so we'll see. Thank you. I appreciate your time very, very much.

Researcher: It's not easy for you.

Participant #1: No, it's good. I got time. I got to leave in about 20 minutes to go pick up Alex for a doctor's appointment. So everything worked out great.

Researcher: Heck yeah. Well, I am going to go fill and drain myself again.

Participant #1: Okay. You do that and you keep, and I'm so excited you're going to be there on Saturday.

Participant #1: You don't even understand. [01:04:00]

Researcher: We're going to turn the pressure up on all Jess. Oh yeah. Heck yeah. Well, it's going to be fun. It'll be

APPENDIX C

Interview with Participant #2

Participant #2

Researcher: [00:00:00] I love it. I'm just pulling up the questions here. I'm going to take some notes while you answer, and then I'll also take this and transcribe it later.

Researcher: Sounds good

Participant #2: to the bottom. So

Researcher: the working title of the thesis is and their impact on the industry's perception of lean construction. So

Participant #2: So I'm doing these interviews with one more time. My internet speed is You broke up when you were saying the name of the so

Researcher: it's unveiling the root causes of lean construction failures in initial implementation and their impact on the industry's perception of lean construction.[00:01:00]

Researcher: Sounds awesome. Nice,

Participant #2: deep, real, meaningful

Researcher: topic. That was my goal. So, I'm interviewing, uh, three lean leaders with different companies. That would be you, Ms. Jennifer Lacey, and Dan Shipley with JE Dunn. Then I'm going to put a survey out for the industry, um, that is made up from some of the responses that y'all have given me, uh, as well as some other questions that I had.

Researcher: And then I'm going to do a case study on my own experience from my first initial implementation. And then I'm going to be able to come up with those reasons and hopefully the industry's perception. All right. So first off, thanks for doing this. I know it's, uh, you don't have to, and I really [00:02:00] appreciate that.

Researcher: Um, responses will be anonymous, uh, unless you give me written permission to use your name or company or anything like that, so, uh, Feel free to be as vulnerable, transparent as you'd like. Um, and that's really it, man. Yeah, let's do it.

Sweet. So can you provide an overview of your experience and background and implementing lean construction principles?

Researcher: On construction projects.

Participant #2: My name is Felipe engineer. Manriquez I'm currently the bolt project delivery services director. It's a national role where I get to play with lean practices and principles, full time 365 days a year. Minus the weekends where I try to take for myself or my family. And I've made the last almost decade of my life implementing lean.

Participant #2: I think actually I'm past a decade. I just forgot how old I was for a second, Adam. So about the last 15 [00:03:00] years, I have been implementing Lean full time on projects inside the United States and abroad through consulting and my work as a general contractor. My background into getting started with Lean started with a frustration in how things were getting done.

Participant #2: And I was working on a project that went into litigation and I saw over the course of a 10 year lawsuit that resulted in settling out of court and mediation, a lot of things that happened that I never wanted to repeat again. Now, I wouldn't give up those experiences for the world because it, It increased my skillset into something that I am today, which is as Jesse says, shiny, uh, even though my work boots say otherwise they're quite dirty, but my experiences have been, uh, implementing lean practices, both on job sites and in offices.

Participant #2: So on the construction company itself, like how the company actually operates [00:04:00] and my last two and current employer, as well as with people on the front line. And then I operate. A few companies of my own, as well as I'm an advisor to some tech startups, and I use lean in all aspects of my life, are most arguably the least in my own personal household.

Participant #2: My family members are quite harsh on how they judge my lean implementation of my own life. But yeah, I never hear the phrase, you're not so lean except for in these and the walls inside of this house. That's okay. Transcribed With the people that mean most to you. And even in that cabinet over my shoulder, it's messy as all get out.

Participant #2: So if I open up that cabinet, you'd be like, you need a five S that shit. Felipe. I'm like, I do. I leave one fucked up cabinet in my life and one shitty, shitty ass drawer, just to remind myself that. Perfection is something we strive towards. And so [00:05:00] what I've learned on lean implementations and the failures, I love the thesis you have diving into it.

Participant #2: The principles we've borrowed from lean manufacturing and adapt them. So the lean construction principles that LCI calls the tenants of lean, which I totally disagree with as names. And that's not how they were even introduced in the original paper by Dr. Lori Koskela. The six principles are respect for people, continuous improvement, and I'm going to say I'm out of order, pooling value, improving flow, eliminating waste, and optimizing the system.

Participant #2: And the two that I work with the most are respect for people and flow. Those are the two that I work with the most. The others come later. And I think, and we've studied this. I've studied, I [00:06:00] nerd out, I've gone deep into research and I can just ramble on forever. And if you can stop me and make me recorrect anytime.

Participant #2: But I've studied a lot, I've read a lot, and I've interviewed a lot of people, including Glenn Ballard and Greg Howell, uh, different times earlier and others like Iris Tomlin and other people, Will Lichtig, who I get to work with at the Bull Company today and so many more people. And one of the things that I found is that most people have no idea what lean actually is.

Participant #2: The far, the vast majority of people don't know what it is. It's just a buzzword to them. They know what lean is from what they've read. In the newspaper article, a magazine, or somebody told them from somebody they heard from somebody that told them from somebody that heard that their uncle did it some long time ago.

Participant #2: So awareness of these things is really low. There's a body of work that goes back to turn on the century. And the, I think the ideas and the [00:07:00] principles are older than we realize, but they get rebranded every so many generations and it just becomes new with some new phrasing, including like even I practice and use, you know, scrum and agile itself is built on a lean foundation, agile, the term is a countermeasure for the hatred in the American ethos of the word lean.

Participant #2: They just didn't want to call it lean because it had such negative connotations and it still does stay like in my title that I told you earlier. Project delivery services director. I work for a group inside the bull company that can't even call itself lean, even though by all definitions and actions and observable facts is a group implementing lean spreading lean across the company.

Participant #2: The press release for my position inside of Bolt says that I'm responsible for integrated lean project delivery and spreading the Bolt production system across the company, which is a [00:08:00] version, it's Bolt's version of last planner system of production controls, which a lot of people misunderstand. If you do last planner, you are lean and you are lean.

Participant #2: If you're doing last planner, that's a misconception and LCI circles, Lean Construction Institute circles, member companies and non member companies. I just heard it as recent as yesterday. I was in an event last night for LCI Northern California, and people were talking about there's this misconception that if you just do last planner system, you're lean, and that's not the case.

Participant #2: It's, that's a misconception, but it's out there. So it's one of the misconceptions that if I just do pull planning, I'm lean, I'm doing lean. And lean is a mindset. And that's why I said the two things that I work with the most are. Respect for people and flow. And then what comes after that often is continuous improvement.

Participant #2: When I first started out with lean, Adam, I thought it was continuous improvement because I was so frustrated with how [00:09:00] badly my project was being run and how unoptimized it was. There had to be a better way. And I was inspired by a person from lean manufacturing that our company. At the time that where I worked, they were so, uh, in need of people, they took a risk and I hired a plant manager who had implemented lean in his company to be a project director on construction projects.

Participant #2: So he brought ideas from lean manufacturing to construction, and we later quickly found that there's this whole community of people under lean construction, and a lot of those people are hyper focused on eliminating waste, which is an incorrect first place to start. Now, there are some benefits to starting with waste elimination for capacity building, and so you can play with the other principles at a deeper level.

Participant #2: But that's a, That's a very immature, naive place to start. And there's a lot of people still talk about it. Even the first book I read was called banish waste in your group. It was just, it was [00:10:00] really just clickbait that Jim Womack had published with a few other people on lean thinking. Lean thinking was the title.

Participant #2: And then the clickbaity catchphrase subtitle was eliminate waste in your organization, which is just not, that's not even what the book's all about. There's a single chapter on talking about eliminating waste. It's, it's a whole other series of steps and things, but that's what people focus on because when Toyota is one of the most famous lean companies in the world was having people come and tour their sites because they want it to be open.

Participant #2: There's 2 things that happen when you allow people to tour your facility. One, it elevates your people and two, it makes your people do better because they know other people are coming to watch. This is human psychological phenomenon. And that was studied and made published in a group of experiments called the Hawthorne experiments that happened in my backyard in Cicero, [00:11:00] Illinois.

Participant #2: Way back in the day that a young William Edwards Deming was a part of, but he was not one of the main featured people in the, in the articles. In those studies, they found that human beings act differently when they know that other human beings are just observing them. And there's a whole bunch of production.

Participant #2: It was a series of experiments done to increase productivity. Anyway, so that paper was published and people at Toyota knew about that. There's no direct evidence saying that, that they, this is why they let people come and tour them. But they certainly took advantage of the benefits of having people come and tour their shops.

Participant #2: And so it was later in a book published and translated into English after Taiichi's death. Where he talked about, he would tell the Americans that doing what they did at Toyota was all about eliminating waste. That was a tactical advantage. In reality, and he said it in plain English, but people would just gloss over it.

Participant #2: The whole thing that they were trying to do was implement [00:12:00] industrial engineering practices so that they can shorten the time for when a dealership ordered a vehicle until the time that they got paid for that vehicle. After delivering it, of course. That was their battle cry to implement the Toyota production system, which took Taiichi over 25 years to implement.

Participant #2: That's a super long ass answer to say that most people have no fucking idea what lean is, Adam. Yeah, that's huge. Um, that's my whole point. Like in, when you read all these things and you start to unpack these principles, like where are these things come from and the whole concept of respect for people.

Participant #2: There's been other books published on why did Toyota bring that respect for people concept in along with the continuous improvement concept. And when you study where Toyota is geographically, where the company first started, As a, the loom corporation does, they started off in the textile industry before they made cars.

Participant #2: They were originally farmers that lived in a very [00:13:00] rocky city area for farming. So the farming was very difficult. It was not in the Valley farming. So the people were very. Used to having to adapt and band together. That half of their company is made up of people who are farmers that had to farm in terrible conditions.

Participant #2: And then the other half of the company was made up of warrior people. So you have a blending of warriors and farmers together and created this very unique culture in the company where they were experimenting, finding ways to work together. And that culture that they have lives on to this day. And even when they interview people at Toyota, Toyota today has over 250 people traveling around the entire world,

propagating the Toyota production system, because even they have to fight against the chaos and entropy of that system coming apart and then losing their culture.

Participant #2: And we do aspects of the type of work. It's no [00:14:00] secret that in the automotive construction of their plants, people have said, lean manufacturing has not come to their construction teams yet. And I have friends that work in Agile inside of some of their technology applications, and they even hire full time Scrum Masters to work in some of their applications, like in Toyota Financial Services.

Participant #2: And so they're bringing in agile through the technology and also through their product development. And it's ironic that the first, uh, scrum taught people at Toyota was exactly the same year that I was taught scrum in 2016. So Jeff Sutherland said, you're the first construction person I see. I just had for the first time ever people from Toyota taking my.

Participant #2: Scrum training, it's happening, like something's changing in the, in the environment. So all that to say, now, those are long ass backstory. As far as implementing lean construction practices, that Dr. Deming [00:15:00] and people from the Toyota quality are from the quality management movement, TQM, total quality management movement of a couple of generations ago, which is all but vanished.

Participant #2: There's the whole quality thing is all fault. No one talks about quality circles anymore. No one talks about, uh, and you even see a lot of construction groups no longer have quality vice presidents. Many of the general contractors have eliminated their quality positions or reduce them down to just managing inspections.

Participant #2: It's not what they used to be. That was the last generation before we got lean in the 1970s or when the phrase lean was coined. Adam, do you remember when Kraftsec coined the phrase lean? What, what year it was?

Researcher: 1990 in the time. Uh, what was the book by Womack?

Participant #2: Yeah. It was the world.

Researcher: Yeah, that's right.

Participant #2: So in the 1990s, we get the phrase lean, which doesn't even translate into all other languages.

Participant #2: I even [00:16:00] met with some Japanese people this week, um, telling me that they don't even use the word lean in their company. And they're one of like the

fifth largest general contracting company in all of Japan. And they don't know lean. They don't know a three. They don't know lean. They know Gemba. Um, there's some other words that they were telling me that.

Participant #2: We use incorrectly and there's some bad translations or some negative connotation words, but there came to the United States to study lean construction from us to take back to Japan, which is totally ironic because it was the US that exported some of the best practices rebuilding Japan after the war.

Participant #2: The Japanese taught lean and again, the right type of culture to receive something. Plus they were devastated after the war, open to change. Even now it's like a bell curve. You have some companies with extreme lean implementation, even though they call it whatever they call it, uh, it's not every [00:17:00] Japanese company.

Participant #2: And if you read the machine that changed the world, Toyota has even changed their business model that they've their supply chain has skin in the game with them. They invest in their suppliers and their suppliers have to invest in them. So it's a very tight network, which is why they can get the gains.

Participant #2: That they have and why they make more money every year than the next three to five competitors combined.

Researcher: I've heard a story of, Oh no, going to the roof saying I need to be able to see my suppliers from the roof of this building. I don't know if you've ever heard that.

Participant #2: Yeah. And there's all kinds of stories too of like, what kind of, there's even legends of Ono screaming at managers in front of subordinates to show the subordinates how serious he was, that he would belittle and downgrade the managers and then behind closed doors, tell the managers that that was just theater to create a catalyst to change and shake [00:18:00] things up.

Participant #2: Because it takes a lot of psychology, as Dr. Deming said in the system of profound knowledge, psychology is one of four pillars that you should do and be good at, but you don't have to have eminent knowledge in to be successful with implementing change in an organization. So, of course, Deming's a huge influence on Lean as we know it today.

Participant #2: Russ Acoff with Systems Thinking. And some of the work done by MIT, there's been a lot of influences on what we collectively call lean, but I'll say to bring it back to the basic principles, it's this idea that human beings matter, or as our friend Jennifer Lacey says, culture matters, Adam, and that, and things can actually get better.

Participant #2: Things can be improved. Those are the, I would consider the foundational building blocks. And there's many different ways that people even draw the Toyota house, like depending on what version you look at, but respect for people is one of the. The foundational pillars that the house can stand on [00:19:00] top of or that holds the house up, gives it some form and structure.

Participant #2: And then you've got that idea of continuous improvement, that things can always get better. And then there's just the other thing that it's kind of culty. Like, uh, the lean community is a bit of a cult and there's, there are zealots inside the cult. And the, and the cult even has like, uh, a priestly class of the old guard lean that, that has all these like traditions and things that they do, and they are gatekeepers to entry.

Participant #2: And then there's people like us on the fringe that we know what it is. We recognize the cult leaders. We avoid them. We take the good from them, let the bad go, and then go and deploy this with anybody that wants to get things better, or that's having a shitty time on their job, or is like frustrated. So like for me, I love working with people.

Participant #2: Project teams that can acknowledge that things are not ideal and they can get better. And then we work together [00:20:00] hand in hand, experimenting as they want to. I don't force myself onto teams, even inside of a corporate company where there's still an incorrect idea of. Resource maximization versus flow efficiency.

Participant #2: I've had leadership at different companies while I've been doing lean as a full time job, use this saying, if it was up to me, I would have Felipe on a project 365 days a year, all the time, always have you on projects, utilizing a hundred percent of your abilities and capabilities. And, you know, from studying, this is lean from Nicholas Modig.

Participant #2: That is the, that is the predominant. Mental model of maximizing resource utilization instead of flow efficiency. Now, the last person that told me that I told him, I said, because I understand flow and we need to talk more about flow, sometimes you're going to see me doing [00:21:00] nothing and it's the best thing that I can do for that project at that moment.

Participant #2: And nothing could mean like keeping my mouth shut, not going, not being on site, not engaging or posting on social media. Yeah. Sometimes the best thing I can do is no intervention because it's not, it, it doesn't require that. I just be constantly engaged in order to make things go right. That's flow.

Participant #2: That's what we're putting flow as a priority over the resources and I could tell stories about, about that. I've got lots of, even just recently from a week ago, I've got some flow stories and what kind of impact that has. But as far as like lean

implementation, so here I am operating as my, my primary job, uh, implementing last planner system.

Participant #2: In [00:22:00] our flavor, we call it the Bolt production system. So it's the five connected conversations and then two additional steps. Uh, one specific to when we self perform and then another one for how we set up our last planner implementation. And then I also support, uh, integrated lean project delivery across the company.

Participant #2: And that's a trademark term that Bolt has because they were part of the pioneers working with Sutter Health to develop the integrated form of agreement. Over two decades ago, which has now been copied by institutes like DBI, a design build Institute of America with progressive design build. And then the AGC has also come along with its consensus docs, 300 integrated form of agreement contracts, which I think is a great thing to have competition in the space for this type of collaborative contract delivery.

Participant #2: And then in Australia, you have this, uh, partnership, uh, [00:23:00] they call it, uh, partnering contract methods, or it has a different name. But it's another type of high collaboration, contracting style.

Participant #2: All right. So I've asked one question so far. I've been rambling for like 20 minutes. So

Researcher: yeah. And I can't stop you because you're freaking full of like amazing knowledge that I love learning. And you've probably answered five or six questions down the line. Um, and I've been taking some, some good notes here.

Researcher: So how long have you been in the industry?

Participant #2: I've been working in the construction industry since 2002. So I got to do the math just at 20. How many years is that?

Researcher: 21, 22.

Participant #2: Yeah, so over 20 years, over 20 years. Now I've worked, um, I have, uh, I just got my social security statement earlier this year. I've had income since I was 8 years old.

Participant #2: So I've had, I've had work since 8 and my dad was telling [00:24:00] me. This weekend. He's like, you've always found ways to pay for things and make money

like magic. He's like, ever since you were a kid, you've been a hustler selling, running and gunning.

Researcher: Tell me a little bit about the bolt company.

Participant #2: So the bolt company is a, as a general contractor, primarily in the United States, they've done some, some work overseas in their past, and occasionally they do work for certain clients.

Participant #2: They'll go into Canada. But for the most part, it's a United States based company, over 20 offices, nearly 2, 000 employees, give or take, depending on the season. Um, they do a mix of healthcare, industrial, commercial, education, pretty much everything except residential construction. And, uh, in, we're signatory to several unions, actually, like, more than eight different unions.

Participant #2: I lose track of all of them. I got to use a I got to go back to the marketing webpage myself to remember all the things, but like operating [00:25:00] engineers were even like in the top 20. Uh, companies in the U. S. that own cranes, we have so many cranes that we're in the top 20 list of companies that own cranes.

Participant #2: So, we have a ton of operating engineers, masons, iron workers, uh, uh, carpenters to do self performed concrete, structural steel.

Researcher: What year were they founded? They were

Participant #2: 130 plus years old. Wow,

Researcher: I didn't know that.

Participant #2: Over 130 years ago. Mm hmm. And, uh, the current, we're an employee owned company as of, uh, the last, about a decade ago, and Tom Bolt is still the majority owner.

Participant #2: And, uh, he is the, I believe the 4th generation Bolt to be running the company. He might be the 5th generation, 4th or 5th. And I actually consider him a friend of mine as well. It's a good. It's a good dude. [00:26:00]

Researcher: What about revenue wise?

Participant #2: Revenue wise, we're operating somewhere around the 1. 5 billion per year. And that's, uh, increasing.

Participant #2: It's going higher. So we're considered a medium size to smaller size general contractor. According to ENR type of categorization, like a solid medium sized GC is what we are. We, we do do a lot of, uh, subcon we act as a subcontractor for quite a few other general contractors because of the specialty type of industrial work we do with, uh, millwrights and different parts of the country, like working in industrial projects.

Participant #2: So that's us in a nutshell. And we have like a strong. Lean ethos that goes back over 20 years when they were trying to answer the question or the problem of a productivity issue, given the labor challenges that they were seeing in the 1990s, [00:27:00] which is exactly when they became a founding member of the Lean Construction Institute.

Participant #2: There's even a meeting in the hotel, according to legend. With like 6 people or 8 people and there was a person from bolt in that meeting and they became 1 of the 1st founding members. Not the 1st, but 1 of the founding members of the link construction Institute. Glenn and Greg started it in the 90s or early to like 2000 water late 1990s.

Participant #2: Those those numbers I'm starting to forget. Probably just need to get a little more sleep. I'll remember it better. But even with that, like the, they have a high appetite for innovation and working on things like, I remember when I was hired over a year and a half ago on my new hire orientation video, I had to watch a video on waste.

Participant #2: So I had to learn about the eight wastes coming in. Of course, I already knew what the eight wastes are. Just downtime, baby. Defects, overproduction, waiting, [00:28:00] transportation, inventory, motion, and excess processing. I just rolled those out of my mouth, like breathing in and out. Cause you gotta be versed in waste recognition so you can reduce it to get back Higher levels of flow because flows where it's at, as you know, it's all about flow.

Participant #2: Flow is King and they've even had, uh, projects that experimented with tech planning over a decade ago, uh, in, in Ohio on some healthcare projects, as well as some other industrial projects and then healthcare projects in California. So they've got a long history of trying to get things out and that they still have the same struggle.

Participant #2: To spread lean across their own company and have like a, what I would consider like a mass adoption because you have so much transient people and workforce

coming through, as well as people just getting promoted. This is like a, one of those weird phenomenon, Adam, that in your research, you might find that.

Participant #2: [00:29:00] When people have a lot of success and they get promoted, their responsibilities change, their focus changes, and they almost stop doing the stuff they used to do. I'm teaching a leadership class with Vic Ortiz on high performance leadership that he's one of the people that taught Glenn Ballard, how to facilitate meetings and laid some of the foundation for what we recognize as the last planner system today.

Participant #2: And those methods go back to the seventies, like how to run effective meetings and what leaders do. Well, As people move up in the organization, their role becomes more psychology and less technical expertise. So it's, as people move up, they stopped doing all that lean stuff that got them successful and promoted.

Participant #2: There's a few people I've met, they've been in the bull company long enough that they were some of those early lean pioneers. And if you didn't know who they were because of papers that were written about jobs that they were on. You wouldn't even know that they [00:30:00] knew what Leann was based on how they, what their job is today.

Participant #2: That's an interesting point. Yeah, they let it go. I asked the person, there was a person that was trained as a facilitator for Last Planter system and this individual is a year from retirement now, so they did heavy last planter system for a decade. They're on a job. I'm going to the job to help the project.

Participant #2: They're having some scheduled challenges and we're talking while I'm getting coffee for like the 55th time in the day. 'cause I'm jet lagged. And the person's telling me about, oh, that stuff you're doing. I used to do that like 10 years ago. And we got to talking and I was like, oh, you're right here. Why am I here?

Participant #2: Oh, that's not my job anymore. I mean, it was just like a, no hesitation, not my job, right? That type of phenomenon I see. And I've seen not once I heard it, I started thinking back in my memory of different places I've been. And [00:31:00] that is something that I see very often.

Participant #2: How would you define a lean construction failure? A lean construction failure would be something that violates the principles. And the principle most often violated is respect for people. A lot of times people have an idea. And like I said, I had people from Japan had come to this leadership training and they're specifically wanting to learn how to bring back best practices to their company.

Participant #2: And these are people that have come up and been superintendents or worked as project managers at construction sites. And now they're working in this corporate department doing a mix of technology type of implementation, like a VDC, virtual design construction, BIM. Coordination and some other schedule type of automation.

Participant #2: And I said, you're going to, you're going to make the mistake that everybody makes. And a lean failure always has this same thing. You think you know better than somebody else and you [00:32:00] try to force your way on them. That's the respect for people violation. And a lot of the times when we go to jobs, like when I go to do recoveries on projects, I get results that other people don't get.

Participant #2: And it's because on the first day or the day before, first thing I'm trying to do is establish and build trust. Whereas other people say like, because of my authority, because of my title, you're just going to listen to what I say. Like you've all messed this up and you just need to change because you're just not doing it right.

Participant #2: And as you know, studying, you love systems thinking that's just not the case. The system that the people are playing inside of created the conditions for what they're getting. They get exactly what the system designed to give them. And they cannot, no matter what they do, do something different. It takes somebody from the outside to come in and to interrupt them in order to impact the system to make a change so they can course correct.

Participant #2: But that first starts with trust. If human beings don't trust you, they will not follow [00:33:00] you. And if they don't trust you, they'll pretend to do what you say in front of your face if they're afraid. But the changes won't be sustained and they'll go back to the old ways that they used to before what the system forces them to do.

Researcher: How often have you seen lean fail? Lean construction fail

Participant #2: all the time, all the time, even I'll even consider inside of the, the bolt portfolio. And they have something like in excess of 2000 projects per year. And we're now using, uh, data analytics and dashboards. And I did a presentation of this at AGC IT conference in Chicago, just a few weeks ago.

Participant #2: I said, we, we got data information and we went because of the data we saw on this dashboard. We knew that this project seemed off and we needed to do something. And when we talked to the project team, um, they were doing a report out during this like monthly meeting, [00:34:00] which is supposed to be a good thing.

Participant #2: Like, people are reporting, sharing metrics, getting help. But when you watch what's happening in the meeting, you realize that psychological safety is so low that people can't speak truth to power. And if you ask questions, uh, your phone starts blowing up. You start getting text messages to shut up because it's not in this theater of this meeting, asking questions and helping people, even though it's set out loud is not the right thing to do because you're in front of all your peers, you know, with your kimono open, exposing your problems.

Participant #2: So what people do is they. Hide the problems. And so the only reason we knew something was wrong because the data had inconsistencies, the project team had two data points that, that could not exist at the same time. It was one was about cost and schedule. And one said things were great. And the other one said it wasn't, and you can't have both of those things living simultaneously.

Participant #2: So something's wrong. [00:35:00] And luckily this project was a high profile project. I had seen some pictures of it, uh, online because there was some news reports. It was super high profile. There's constantly getting the media was going to it for good reasons. And I could just tell based on the picture, there's no way that job could finish.

Participant #2: And the time that I had left based on the pace that it was going, and so that was a failure. Now, that 1 example, I see in the portfolio all the time. Now, if we just listen to what the people said, they were doing last planner, they said they were doing it and they'd even have pictures from their conference room.

Participant #2: So behind their imagine behind their web camera. You see sticky notes all over the wall and the last plan are up and all kinds of stuff. And to the untrained eye, it looks like it's happening, but to the trained eye, you'd see that all the sticky notes are in the same handwriting.[00:36:00]

Participant #2: You'd also see no evidence of pull planning. You'd hear no conversation about what milestone they were working towards.

Participant #2: So there's all these things that are, you know, red flags for basic things.

Participant #2: Yeah, it's just little stuff like that, but it really keys you in now, a contrast that I went to a bolt project, uh, project manager started off as an intern bolt 8 years ago in her internship, they were converting a bookstore into, uh, a medical hospital examination type of treatment center. Yeah. And she learned Last Planner System from my current boss, Nick Lawhorn.

Participant #2: He was teaching their whole team because it was such a complicated type of conversion that they needed to use Last Planner System just to make it. Right? So it was like a, just a perfect storm. And that worked so well for that team. The [00:37:00] team was newer that they all just thought this is the way it always is.

Participant #2: And so fast forward eight years later. She'd been using it on every single project, including the one she's on now. And she's on an IPD project, integrated project delivery in Chicago or advocate of rural health. And the client lives and breathes lean because they've had a lean adoption. And she's, she's been lucky that she's only worked on lean projects her entire career.

Participant #2: I walk, I step onto her job and they're having, I'm there because I'm actually going to record like a good. A video of like what good looks like for how to do like a certain part of the bowl production system and she's running, she's interchangeably running the foreman meeting because there's superintendents talking to the city and when he comes in seamlessly, just go back and forth and run the meeting like a perfect combination.

Participant #2: It could have been like the one person, like you wouldn't even know who was in charge and the [00:38:00] trades were all like on iPads. And highly engaged and looking ahead. And they had sticky notes on the wall and they had a digital solution on a TV. And this isn't a trailer. That's only one trailer wide. It's a tiny trailer.

Participant #2: And then I started talking to them. They're projects two months ahead of schedule. We walked the job. It's the cleanest job I've ever seen. They prefab the job. They converted a Toys R Us into a, a medical office building. So it's an old abandoned Toys R Us. The whole job was modular, so they literally like opened up a wall and brought in all the modules and then put it all together like Lego pieces on site.

Participant #2: The Bolt also has a modular group, which they've been experimenting with for quite some years now. And the contractors were high morale, joking with our staff, positive joking. [00:39:00] I went into the restrooms cause I always check the restrooms like a fanatic, like Schroeder does me and Jason checked the bathrooms, zero graffiti in the restrooms, immaculate.

Participant #2: Immaculate hand washing station, not even no scraps of anything on the floor. Job site so clean that if you spilled your food on the floor inside the job site, you could eat off the floor.

Researcher: So are these ways you measure, or how do you measure the success of lean construction within the bolt company?

Participant #2: I measure success and a real basic terminology in business terms.

Participant #2: Does this give the owner what they want? Because the whole reason that there's a project is because the owner has a need that building a building solves. And so if we give the client what they want, I would just mark that as a success. And then there's different like facets of what that success is in terms of.

Participant #2: You know, cost schedule, people, people, development, [00:40:00] morale, it's, it's complicated and what kind of key performance indicators you can look at. But at the end of the day, if we had like a super high rah, rah, everyone felt great, but the owner doesn't get the, what they need, that's a fail. I don't care if they used every lean tool.

Participant #2: That there was, but nobody does. Nobody uses more than three or five tools ever because there's just so many, there's over 50 different types of continuous improvement, lean tools. Some are more sophisticated and less used and less useful than others. So I just consider if the owner gets what they wanted.

Participant #2: It's like they always say, give the customer what they want at the right time and the amount they wanted at the right quality, that's a win. And in our industry, Adam, it's so bad that it almost never happens. Customers are used to things being late over budget, low quality, some owners. Especially ones that use AIA contracts even have provisions for how you're going to manage the punch list [00:41:00] because they just expect that it's going to be crap at the turnover and they want you to tell them what your process is to fix the crap that you made during the process of building their building.

Participant #2: To me, that's a failure. Some of the higher lean intensity project teams that I work with. Have come out of the closeout phase or the turnover phase, the substantial completion with a punch list of less than five things and the architect joking that I had to put something on there because it's in the contract, I had to find something, but this is the wall and put it on there exactly.

Researcher: But so what, what would you say are the most common reasons why lean construction fails specifically on the first implementation at Bolt?

Participant #2: So, and this is not special to Bolt. Like, I've said this, like, American construction practices, I had Sean, uh, Greystone on my podcast and we, he talked about this at length.

Researcher: On has been on good night.

Participant #2: I know Sean has been on man. I was like, where are you [00:42:00] been in the weeds? Yeah. You've been, you've been busy with the lean builder

Researcher: and the kidney.

Participant #2: Yeah.

Researcher: American construction.

Participant #2: So Sean says that if you look at American construction practices, it's, it's virtually unchanged since the civil war.

Participant #2: So from the 1860s to now, it's almost completely the same. And he, and he even talked about something that I never would have thought about. That's a show worth watching, Adam. He talks about the insurance companies. And I was thinking insurance companies and bonding companies. So I was about insurance and bonding companies and their one facet of our industry that we see it as a tiny little line item on every job we do.

Participant #2: It's a massive influence on how we do what we do. Yeah. Rewatch that show.

Researcher: Sorry.

Participant #2: I said, that's a show you should watch.

Researcher: Well, yeah, I got it. I got it on my scrum board now. And

Participant #2: so I've consulted [00:43:00] overseas in both South America and Europe. Okay. And even talking to the watching and I asked the people from Japan, why did you come here?

Participant #2: What I've, what I've realized talking to people and including, I have a friend in South Africa and a friend in Australia, American construction practices have been exported all over the world. And everybody incorrectly thinks that the American way is the best way to do it. And so you see these, these brain, I would just call them brain damaging practices of like this very high confrontation, uh, high extreme hierarchy type of situations.

Participant #2: And like some of the worst I've seen is actually in Germany. And Germany, where we think like, I even went to a project where they had like this quote unquote, high tact implementation and they had full time lean staff where they just call it lean, like it's a lean staff and in their, in their works, I saw people being [00:44:00] disrespected.

Participant #2: I saw what looks like slave labor, but it's not slave labor, but they're, they had people from different countries coming in to do what's, you know, the frontline blue collar work. And the conditions that people are working in to me would never fly in America. And I say that, and then I have to think about residential construction.

Participant #2: It's like, okay, I've seen that. I've seen things online. People share some of the very dangerous conditions that people in residential construction in the U S have to work in. And it was akin to that, but this was in a commercial construction setting in Germany. And I think construction in South America is the same.

Participant #2: And it's this American export. Of these things that Sean said, does our practices from the civil war, post civil war. So the eight late 1800s propagated around the planet and it's all on the structure of how things come together. And a lot of it starts with the owner's contract and the owner, the owner [00:45:00] contract creates the construct contracts.

Participant #2: And just most basic terms is what our agreement is for what you're going to do. It's a written agreement. This is a written, it's just written down what we agree to do. You're going to do this for this, for this amount, in this amount of time. And if you read that we did a exhaustive research, I was working with the construction industry Institute.

Participant #2: We did a collaborative scheduling paper. Coincidentally, we use scrum to deliver that paper in about half the time is they fucked up and made me the chair of that group. And I scrummed the whole thing. I taught everybody scrum and I said, we're going to go the whole way. The funny thing is we did a meta analysis of the predominant contract types in the United States, and we found that outside of the collaborative contracts, like the IFO ways.

Participant #2: The consensus stocks 300, which is based on that Hanson Bridget IFA contract or like the Sutter model, uh, the progressive design build. So, those aside, all the other [00:46:00] contracts do not have the words, the word collaboration doesn't show up in the contract and it would tell you, like. You know, 17 pages of what you're going to do in case of a dispute.

Participant #2: That's a red flag. So the contract's telling you like, this is what's going to happen when we fight. And if you think about any type of public works job, that's like a division, one spec division, one spec usually has all the, the guidelines, the general requirement type of things. Almost all of it is what to do when we're going to fight.

Participant #2: So we have this system, the predominant system, and especially in the hard bit work, which is the predominant, uh, type of contract method you've got, everyone's going to fight. Like we just agree that we're going to fight each other and you have, uh, owners treating contractors like thieves and you have architects learning and architecture school that the contractors are thieves and that they have to protect the owner from the thieves.

Participant #2: And so you have this very low trust type of environment and the contract says exactly the same [00:47:00] thing. When you analyze the contract, you can tell that it's a low trust contract. So I think that that whole, how we get together creates the conditions to propagate nothing but lean failure. So you're, you're fighting, it's an entire system that we're fighting.

Participant #2: That's why I love the word change makers for the people like you and me, I don't care what your route says, or implementing lean construction practices. And affecting change because we're operating in a system that produces dog shit. You can put that in your paper. Felipe said operating a system that produces dog shit.

Researcher: I need that in writing that I can put that in my paper.

Participant #2: It's a system that, that creates conditions so that we have the highest suicide rates since before COVID. So before COVID to now construction, it creates the conditions so that people that are on the fringe of considering taking their life, take their life.

Participant #2: And we even had, uh, another Sean [00:48:00] Greystone, uh, his cousin works at, uh, oh my God, Harvard. He works at a Harvard. He was Harvard trained psychologist working at a hospital in Boston, I believe. I just can't remember if it's like mass general is the name of where he works, but he, his full time job is working with people, uh, military veterans.

Participant #2: And we were looking, he was telling us, we were having a series of meetings before we did a workshop for construction people. And, uh, and I just can't remember his name. His last name is not Greystone. It's something else, but. But the good doctor said, and Sean's, uh, daughter is a clinical therapist in Nevada, in, uh, New Mexico.

Participant #2: And so both of them were telling us about the statistics. And they said that instruction has more suicides, even than veterans. And that if you look at just the numbers. More people take their lives in construction that we lose in wars. We fought wars, uh, by suicide and [00:49:00] like that, that means, and they said the, the, the, it's not one thing that makes somebody kill themselves.

Participant #2: It's a Siri. And I even had Frank King season one of my podcast that, you know, that you got to get on some point, Adam, I had Frank King on my podcast used to be a comedy writer for the Jay Leno show. And now he's created a whole, uh, his whole career now is like speaking against suicide prevent or speaking for suicide prevention and intervening and bolt has a gatekeeper program that also is focused and I'm a gatekeeper myself trained to intervene on people that are considering suicide.

Participant #2: So you want season 1 Frank King? That's a good episode to watch. I'm going to start doing some clips from that show to the. To get it out there because

Researcher: I found so sorry to sidetrack you. I found Opus AI. Have you seen that yet?

Participant #2: No, not yet.

Researcher: Dude, you freaking take, it'll take a YouTube link and it will automatically go and pull what it thinks based on [00:50:00] whatever algorithm it'll pull like minute to two minute clips or whatever you tell it to.

Researcher: And they're pretty damn good, man. So

Participant #2: let me, let me punch it in so I don't lose it while we're talking.

Researcher: Opus and you get like the first, I don't know, a hundred minutes or whatever for free. So,

Participant #2: okay.

Researcher: It's really, really good.

Participant #2: The opus. pro for AI video editor.

Researcher: Yep. That's, uh, let me just

Participant #2: say, I too, this text to video generation using AI.

Participant #2: Check that. I'm going to use the, let me use the restroom real quick. I'll be right back.[00:51:00] [00:52:00]

Researcher: It's opus. pro. Opus. pro. Okay. Thank you for that.

Participant #2: Thank you. Got it. But I'm going to try that on that episode with Frank and see what I get. So I remember Dr. Adam, he was saying about the suicide and the veterans is spent his everything, his entire career working to intervene. And he said that it's a. And, and looking at the factors that create the conditions for suicide, it's a complex issue, interrelated things.

Participant #2: So you need a lot of things to happen. A lot of things have to be in play. And then it's going to be a straw that breaks the camel's back, that pushes the person over the edge. It'll be something really small. And it's very hard to discern when it's about to happen, but there's some, there's some patterns to see that it's about to happen.

Participant #2: And you can take it, you can actually intervene and prevent suicide. Suicide is a hundred percent preventable. You got to be able to recognize the pattern. So [00:53:00] at Bolt, we get trained in the gatekeeper program to recognize the pattern and actually do a positive intervention, not just make somebody call a helpline, we're actually trained.

Participant #2: To intervene.

Researcher: I love that, man. That's, um, yeah, I, uh, I've had my fair share of run ins with that and I prayed I would have had some of that training, but so let's refocus here back to lean. Um,

Participant #2: yeah, the lean side where I'm going with all that, this industry we have because of the contract style, which Sean says has to go with, it goes back to the bonding companies and the insurance companies have a factor in the system.

Participant #2: It's the entire system of how we build things that creates the conditions for lean to never take stronghold because you're fighting against the predominant systems and traditions and norms in construction and the norms are so, uh, [00:54:00] dominant that, you know, it's hard to recognize them until you experience something else.

Participant #2: So a lot of the things I studied, like when I studied the manufacturing and agriculture and technology and software development, you see that there's in other industries, there's different, there are some different norms. It's only when you see the different, you come back to your everyday experience that you can see the contrast.

Participant #2: And my one buddy, Mark Tree says that contrast is the essence of vision. If everything is the same, you can't perceive or discern anything. You need things to be, you need to be able to register differences. To actually have sight and see. Yes, the whole

Researcher: fish is the last to discover water. Exactly. How about, so can you share some examples of LEAN tools or techniques that have been successful in improving performance when implemented on the first LEAN project for a team?

Participant #2: Yeah. So the very first thing that you can do [00:55:00] is, I mean, I steal from Toyota all the time. So principle number seven, use visual controls so that no problems are hidden. Most of the time people have no idea why they're building what they're building. So there's, I've had several, uh, lean implementations where the team for whatever reason does not like the word lean, they don't want to do lean.

Participant #2: So I don't push it on them. So instead we talk about the issues. You always have to take an earful. So I do a lot of listening about how people suck at people. Leadership will tell you like how everybody sucks. Like terrible trades, terrible staff. I mean, everybody is stupid except for them. So I take time to just absorb it.

Participant #2: Listen, people need to be understood. Uh, somebody smarter than I came up with this concept that it's a more powerful human emotion to be understood, even then for the desire to be loved. And so if you could take time to understand somebody. Doesn't matter if they're right or wrong, just understand them and really understand them.[00:56:00]

Participant #2: You now have an opening and you've created some vulnerability and space for trust to have a foundation and a leg hold. Then you can implement that first technique of using visual controls. So there's one job in particular, this job was going into litigation. It did actually litigate. It did litigate.

Participant #2: This is a. This was like a decade ago. So when the first times I use this principle as an intervening method, and I've used it ever since because it worked on the impossible and it's works on everything. It's just never, it doesn't work. It always works. So the first thing we did was what is the important date to hit?

Participant #2: So this job had lost every, this is one of the classic every day, every week worked.

Participant #2: So like, and it would happen for over a year, uh, management fired, like everybody, the staff turned over like three times. And it just kept turning over. It was a design build project, which is more ironic. Like if, for people that know what design

[00:57:00] build means for that staff to have that much turnover and things changing and losing time every day they work, the team could have sent people home and shut the job down.

Participant #2: They would have finished fast. They would have, you know, but they kept showing up, right? So this is the job. So it's been a year. It's they're on, they're headed towards year two when they're going to finish. And the job should have finished in 12 months. Yeah. So they're past 12 months and there's still another 12 months of construction.

Participant #2: That's how this is true. This is a true job in California. And so I asked the superintendent project manager, what's the date? Like, what date do you need to hit? They didn't have an answer. And so we had to have a long conversation about, like I said, just listen, understand them. But then after that long conversation, we got a date and I said, can we do one thing together?

Participant #2: Can we take that date and put it up in the conference room where you meet with the trades? One date, so we created one big milestone [00:58:00] sticky and we just put it in the, in a very dominant or a very obvious place where people would see it and it would like stand out. And I said, when you have your next meeting, which is going to be later that morning, can you point to this date and just talk to it and tell people what what the state means?

Participant #2: And the superintendent's like, this is so stupid. This is not going to work. Like, it's not going to work. I was like, I'm here. I'm here. I'm just here to help. I want to try this as an experiment, with your permission. And you talk about why this is important. We've talked about it. We now have a Common shared knowledge of why this is important.

Participant #2: So he did it and that team made up time for the first time ever. They actually hit dates. Is that

Researcher: you or me? That was me. It's time to take my meds, but we're good. Take them. No, no, we're good. I only got 15 more minutes with you. I want to keep, I want to [00:59:00] earn it. I can't believe that I've been talking for an hour.

Researcher: This is obnoxious. It's so much fun. Right? Uh, well, let me hit you with a couple more.

Participant #2: So that, that real, real quick after that, we, it took me 15 visits to that site. Before we can do pool planning. So 15 times of just using visual controls to make

things visible. We did pool planning with the team. I bought pizza for the entire team for all the foreman.

Participant #2: Of course the company reimbursed me cause then that's my deal. Right. And then that first pool planning meeting, they gained two weeks in the schedule in the first, very first meeting. And then they still went to litigation because people were so pregnant and wanted to upper management, wanted to fight, you know, people's feelings had been hurt and they needed to get their vengeance.

Participant #2: And that's a very true psychological phenomenon. But at least the foreman could now work together. [01:00:00] And so regardless of how the ultimate outcome was, you know, some lawyers had to get involved, but people could talk to each other again on the site like human beings. And for me, I consider that a win, even though the job.

Participant #2: Was going to go litigate because before then people could not talk to each other. And so making things visual is if you read a lot of strategy books and I took strategy when I got my master's of business, you know, they always use all these metaphors about navigation, uh, and terrain, and even a Toyota, they have this concept of, uh, ocean Connery or that North star, those are all navigation type of language, and even I talked to, I have indigenous, uh, friends here in the U S and they talk about in their culture, they have this.

Participant #2: Whole ethos of navigation and knowing where you are in the world. And that's what strategy really is. It's knowing where you're going to go. And once you've set where you're going to go, now you can take action to get [01:01:00] there, right? Like what, what other questions you got? We might have to do a part two of this freaking thesis interview.

Researcher: The Japanese have the word Kata and that's exactly what you're explaining. Have your goal, figure out your current condition, establish your next milestone, and then experiment.

Participant #2: That's the Toyota Improvement Kata. But Kata itself means a habit or a practice. So Kata is a, is a type of martial arts practice where you practice forms are patterns of movement.

Participant #2: So that when you're into battle, your subconscious mind takes over and you don't have to consciously think about moving your body and your body moves without your actual brain thinking. It's a type of habit and

Researcher: pattern. All right. Who do you engage and involve in the implementation of lean construction on a project?

Participant #2: Anyone that'll listen,

Participant #2: it's almost always the. You know, the, the project leadership, [01:02:00] but on the slide, there was a job that we did an intervention on, uh, in the South, the United States, I'll let it be a little anonymous to protect the guilty. The, the most open person to it was the intern and the project engineer, the manager and the superintendent were disinterested in making the changes, but the intern and the project engineer were all about it.

Participant #2: Because they've been eating shit for a year, it'd been, it'd been really tough eating shit means that they had a really tough time on that project because frustration was high and things weren't going well. And so by prioritizing flow, we built a lot of capacity and change the dynamic and the culture of that, that whole team.

Participant #2: And the intern was interacting with the trades every single day. Even more than the superintendent. And so by working through the intern and the engineer improved schedule and the superintendent eventually came along, [01:03:00] but it was those two people that created enough energy to make the change that that project recovered more than six months and the owner even gave them a time extension when the owner realized they wouldn't be ready with the owner furnished and owner installed items.

Participant #2: They had to give us an extension. It's hilarious. You ever involved the frontline workers? Yeah, you know, occasionally I will talk to the foreman, especially when we do last, so the tool of the tool that we get to go deploy, because that's what I get paid to do is to implement last planner. I get to talk to foreman all the time.

Participant #2: There's another job in Oklahoma, it was a school project and we were going to implement BPS full production system, last planner. And it was the iron worker foreman that told our superintendent after the pull planning meeting and that pull planning meeting, we saved a month of the schedule. And everybody got more time.

Participant #2: So we created a pull plan where every trade [01:04:00] got more time than the CPM schedule said they had to do these activities and the schedule on this current phase of enclosing the building. It's going to finish four to six weeks faster than what the schedule said. That superintendent for the ironworkers told our superintendent, Felipe is not like anybody else I've ever seen.

Participant #2: That's talked about this type of stuff. Cause contractors, general contractors try to do this all the time. He said, he told our superintendent never piss Felipe off. You better take good care of him because he knows what he's doing, which is hilarious because I was cursing up a storm during that training.

Participant #2: I mean, it's like, One of them. And I think that's the key. Like when I, and I do initiatives too, like when I said, I work sometimes on the company and company initiatives, changing the business, but a lot of times in the field, and, uh, even though I have an electrical engineering bachelor of science and a master's of business administration, I still can connect with the trades because in my past experiences, I've been a superintendent and I've had to lead foreman [01:05:00] into a project.

Participant #2: So I've had many different leadership roles and I can kind of walk between blue collar white collar seamlessly.

Researcher: Yeah, I think that's an important skill. Um, so what advice or recommendations would you give to an organization looking to implement lean construction for the first time?

Participant #2: You don't need to be an expert and spend 12 months studying it.

Participant #2: But if you're, if you're the person that's going to bring this to your company, you need to have some basic understanding and practice yourself. And so if you think that you're going to bring something to your employees and just make a proclamation and stuff's going to happen. You're going to have a rude wake up call and experience a ton of failure.

Participant #2: Did you need to get good at some of the tools and practices? And I would say pick tools and practices and solve practical problems for your business. Not every business has the same type of problems, but there are categories of problems that are predominant. Uh, so like [01:06:00] not enough labor. Is a, is a problem that everybody in construction has.

Participant #2: So anything you can do to increase flow using tools like last planner system or scrum or tech planning to improve schedules for teams can allow you to level resources with people so that people don't have to work too hard, become overburdened, but still put a lot of work in place with low effort. And it doesn't mean that there's not talent or skill.

Participant #2: It just means they don't have to work stupid hard to barely get stuff done and be put under stress. And so I say, learn those things, get some basic understanding,

maybe phone a friend, talk to an expert, a coach that you can trust and work with you to help you see the gaps. Cause you're not going to see the problems right away.

Participant #2: We talked about that perception and contrast. So figure out what, what's a business problem you have. And then go after that single thing, get some small wins, and then let that snowball effect in your organization to do more things, get more people involved [01:07:00] and make it voluntary. Now I say this all the time.

Participant #2: I haven't, we have a friend, you and I, and he has made the implementation non voluntary and his company is a small company of 20 ish people. And I work with a company in Ireland too, Jason Casey, season three, EBFC show, you can hear about that implementation in Ireland. I helped them with now at the time was a 70 person company.

Participant #2: And they mandated, we're going to do last planner system now in their culture, it worked and they can make that mandate because it was a family owned business and like, everybody's related, like, it's literally one of those places where they're all related. Right. And so like when the, when the family decides it's okay and it works in that culture, but here in the U S for the most part, voluntary is better because it creates pull.

Participant #2: And if you're solving a problem, making life better for people, it's easier to adapt and they'll come. You'll have people joining up and getting involved[01:08:00]

Participant #2: like that. Um, that was

Researcher: well said. Thank you. So what do you think the industry's perception of lean construction?

Participant #2: The industry thinks lean is an acronym that they never say out loud. Less employees are needed. Everyone thinks it's to do more with less. And that's, it's not true, but that's what the predominant thinking is.

Participant #2: And even when craftsec, there's a quote about John craftsec that was working at MIT research group. And they said, we don't want to just call it Toyota. Toyota's culture has this culture of it's too hard to explain. And he said, the easiest thing I can think of is that they have just the right amount of stuff, the right amount of energy, the right amount of effort.

Participant #2: To do just in time to things that need to be done in a system, in a systematic way. It's a super long way of saying the guy's like, it's lean. There's not too

much. It's not too little. It's just right. It's Goldilocks and we can't call it Toyota because it would just turn everybody off and it's not going to sell books, [01:09:00] right?

Participant #2: So it's called the machine that changed the world. And they, they tried looking at assembly and manufacturing companies around the entire world. And they kept coming back to comparing against Toyota because there are researchers doing research. They were doing a benchmark study and even they say today, like there's a video by them at the lean enterprise Institute.

Participant #2: And Jim Womack says, don't do benchmarking, which is ironic because the book that made him famous was a benchmarking case study book of all of these lean manufacturing companies that were copying Toyota one way or another. And so I think people misunderstand lean as, as, as a way, like a cheat. And then the media will even say things like.

Participant #2: Due to, to become more lean or lean it's always associated in mainstream media is job cuts. It's always job guts or price slashing or reducing quality, which is just the opposite. So that's the [01:10:00] misunderstanding. And I think a part of it is just, that's the wrong word. There's no good word to describe it, but the word's going to change where you and I are living right now at the time where we're have a.

Participant #2: There's a generational shift happening now, and within five or six years, Adam, there's going to be a new word to describe lean as we know it still, and we'll be alive to see the transition happen. What do you think that word is? I have no idea. I know that it's time because it's been too long. It's been, it's past a generation, which is about 20 years.

Participant #2: So the word change maker, yeah, yeah, maybe.

Researcher: Um, okay. So last question for you, can you please list and rank the five most important factors that contribute to the success of lean construction on the first attempt?

Participant #2: Okay. Number one is commitment. [01:11:00] When a person decides that they're going to do something like by a mentor, Jeff Sutherland says the universe co conspires with you to give you exactly what you want.

Participant #2: So, factor number one is commitment. It takes one person making the decision that changes everything. Without commitment, no change will occur and no change will happen. The second thing is, you've got to have some intuition about what to do. It's not enough to be able to say that the conditions are suboptimal.

Participant #2: You have to have some kind of intuition to guide you. So, intuition is the second factor. After commitment. To make a change after you have intuition that leads you to something to improve the third factor. I would say is discipline because it's not going to work as you think right away, but you need to be just crazy enough to keep doing it, even though you're not seeing results immediately.

Participant #2: There are linear and non-linear [01:12:00] things, and in the environment, and especially in construction, because it's complex, most of what happens is non-linear, which means you can do three things and then, then you can observe a change. You can observe a change has occurred, but you don't know if the three things you did, which one had the, which one caused the change, and it might've been all three at different levels that actually created the change.

Participant #2: It's complex. So you don't know. That's why you have to have discipline to stay the course and keep trying. Then the next thing you need to do is you need to be observant. You have to be able to perceive with all of your senses, because as things change, what you first started doing, it's not the thing you should continue to do.

Participant #2: You've got to evolve and adapt. So you need the power of observation with all of your senses so that you can adapt. Is that, what is that four? Okay. Well, the last one is you need. Childlike wonder so you can be playful [01:13:00] and that being playful and childlike is super important that that fifth one is like one that I think I guarantee you none of your other people are going to say childlike play people childlike play.

Participant #2: When I look at, you know, the type of programming that people have, you look at how kids come into the world and what they do. I was talking about this with Laura Cooley earlier today. And I said, kids never beat themselves up for making mistakes when they're really young, they, they try things and then they just get over it when it doesn't work and they learn and adapt quickly.

Participant #2: And that play is where they practice things with no consequences and that they're never in stress during play. And I said, I think play is something really important that we're missing as adults, as I'm talking to another individual today, and they got some feedback from a supervisor. And the supervisor was telling [01:14:00] them that they were too playful with the client and that that was not appropriate in a professional setting.

Participant #2: And that's the type of bullshit in the system that you had to overcome, where you're telling people to check parts of yourself at the door, not be playful, and to lose that childlike quality that got you to exactly where you are today, alive. If you didn't have that as part of your development, you wouldn't be able to be here and adapt.

Participant #2: So I think it's important to bring it back to an appropriate level so that you can keep adapting and play

Researcher: another day. What did I miss? What other questions should I be asking? Or what are the thoughts do you have on root cause of failure on initial implementation?

Participant #2: I think, you know, it's all invisible.

Participant #2: The things that caused the initial implementations are all invisible things. A lot of people don't realize that the way that they think about things is getting them [01:15:00] exactly what they get. I was in a training where we did a survey at the beginning of the training. We asked people, Like some basic ideas about pool planning, and then we ran them through a series of experiments, exercises, not experiments, but exercises with some different lean tools, including tact.

Participant #2: And the funny thing was that the people that were the most adamant that schedules were super important, specifically waterfall schedules, CPM schedules. During the exercises, not one time did they use the waterfall schedule that was given to them because someone else created it and had they followed that schedule, they would have finished their exercise on time or early.

Participant #2: Well, like all human beings, if you don't have a hand in co creating something, it's not yours and it's somebody else's idea. And I think that's a, there's a, we under, under understand psychology and how people actually work in lean [01:16:00] implementations. And you can't tell what somebody's philosophy is until you have some experiences with them.

Participant #2: They can't tell you what they think. Like, if somebody asks you, what's your philosophy about this, they won't have an answer for you unless they've thought about it and had some experiences where you can discern what they're really going to do when it's, when the clock is ticking and it's time to do something.

Participant #2: So you need some experience with them to observe what their philosophy is and then create some dialogue to let them explore and reflect on what it is. It's invisible. Most of the things that cause the failure are untraceable, unseeable, unknowable.

Participant #2: Sounds like

Researcher: my paper is impossible

Participant #2: is what you're telling me. Oh, but I mean, you can, you can discern them. So it's mental models. Yeah. People [01:17:00] believe mental models are, they're hard to see and perceive. And even in surveys, when people start to think what you're asking them. There's a bias to giving the surveyor what they want.

Participant #2: And so you have to there's a lot of tips and techniques to create surveys where you're asking the same question in multiple different ways to actually discern the real answer. It's like a lot of example of this. We did in the research. They ask people about schedule performance and people lie, everybody lies and says that their projects are on time.

Participant #2: And then you ask other factors about, um, hitting milestones and, you know, speed of work, and then people answer those questions, honestly, cause they don't, they don't get triggered by the job on schedule. I was in a big room like eight years ago. It was a, a 100 person team, huge campus for a tech company in [01:18:00] California.

Participant #2: And it wasn't, I was, I was acting as a consultant for another general contractor, and this contractor was so proud of like how great they were. I did a quick survey in the room during the introductions. I said, how many people, um, think they, they know if this job's on time and on schedule? Everybody said yes.

Participant #2: I said, okay, with a show of hands. With your thumb up, your job's gaining time, thumb sideways, you're just perfectly on time. Thumbs down, you're losing time. Everybody put their hands up and vote. Every single hand was like this to this, except for one person had their hand down. The one person that had their hand down was the superintendent, the general superintendent.

Participant #2: The only person on a 100 staff that knew that they weren't making it. And I told him, I said, this is, this is what the perception of all of you, because of the room that you're in and how you're set up, you think you're crushing it. And there's only one of you knows that you're not making it. And I said, look at the superintendent, [01:19:00] high stress, uh, super frustrated.

Participant #2: All of, you know, that, and you, you, you attribute it to personality flaws. And character traits when a reality is all of us, how we're working together. That's causing this person to feel the stress and they're shouldering this burden by themselves at the expense of their health.

Participant #2: I said, that is a failure to use visual control so that we all know what's going on now and I've told him and knowing out loud with your fingers that one person thinks it's not going well. And in fact, I'll tell you as a consultant specializes in this type of stuff, you are way behind schedule. You are months behind schedule.

Participant #2: I said, you've got to make it visible so you can see it and understand. And that's what they worked on was making a visual.

Researcher: You're the jam, man.

Researcher: You gave me [01:20:00] answers that you're right. Not many people are going to give me. And I love that. That gives me a lot to dig through.

Participant #2: Yeah. Thank God. You're going to transcribe this and use it. And then you can clean up my language as you see fit.

Researcher: Yeah. My, my advisor's pretty cool. Okay. Awesome. What else?

Participant #2: Anything else? Yeah. Send me whatever you got to send me or how I got to reply to you that you can use my name and company because both is super transparent. We're, we're hosting some Hungarians next week and the whole reason we're hosting it was because the person they're starting to leave, you know, because of Janusz, this is how freaking all our Janusz is.

Participant #2: BMW goes to Hungary to open up a BMW plant and they, they, he implements tech planning with this team. This company has been in business for 25 years. They've never experienced anything like it ever in the existence of their company. And they don't get this. They don't even use schedules, dude. If they build, they've been building for 25 years and never even had a schedule until [01:21:00] Janusz comes.

Participant #2: So they go from zero to tag time hero. And they're like, they hire a special person that's got getting her masters and, uh, lean and last binder system to implement lean in their company. And then she's doing research for her paper. She keeps finding all these Bolt company cited papers, contacts Bolt through our website.

Participant #2: Our people get her in touch. Eventually it gets in touch with me. And then now, like within six months, we're hosting them. They're coming to the U S next week. We'll be with, I'll be with them all week, uh, in Wisconsin and in California, showing them different projects. And then including our visiting our main corporate office, where we've got a full lean implementation command center.

Participant #2: That my, my swim buddy, Doug Doolin put into play. It's a high visual. It's a series of a threes by all the executive leadership, all working on specific business problems. And you can see all the A3s in one place, dude, Adam, you and I could just stand there and this command center for like days, [01:22:00] we'd just be like in heaven.

Researcher: You said this is in Raleigh where Doug is.

Participant #2: No, Doug's in Raleigh, but this is an Appleton, Wisconsin at the corporate headquarters. So we're going to bring 16 Hungarians and only like two of them have experienced that project and did a lean pilot. The rest of them have no idea what they're coming to see other than it's this lean construction thing.

Participant #2: That's how tough freaking baller bolt is, man. Like I love bolt. Like, even though we could host international people like that is a testament to what kind of culture that they have. Yeah. A hundred percent. When I first got hired, I used to tell my boss all the time, like I'd call them and be like, dude, you guys do this.

Participant #2: Like I had so much enthusiasm, like. Nobody does this. Like this is good. And he would always laugh at all the things that he takes for granted because he's only ever worked here. And the stuff that I tell him is like totally different bucks. The trend,[01:23:00]

Researcher: which is typical and how we were. Most of us were brought up. I mean, you don't share stuff. You don't bring foreigners in, you don't,

Participant #2: you don't post on social media. You know how much shit I've gotten over 15 years because of my, Social media posting even now we could do a whole podcast. I'm doing a presentation at LCI on social media for change makers.

Participant #2: Where I'm going to like, pull the curtain back on analytics and share some things. And actually I got a meeting next Tuesday afternoon with. Alyssa, who is the marketing manager at scrum Inc. And we're going to do a presentation to Dr. Jeff Sutherland and all the other scrum trainers in Boston. I'm hanging out with Jeff this month, bro.

Participant #2: Nice. We're going to be at Jeff's house in Cambridge, Massachusetts, and we're going to hang out and we're doing, uh, Alyssa and I are going to do a one hour [01:24:00] presentation on social media.

Researcher: That's awesome, man.

Participant #2: Yeah.

Researcher: So I'm going to be in Massachusetts at the end of this month.

Participant #2: Oh, you are?

Researcher: Yeah, 25th through the 27th.

Participant #2: Dude, I think we're there at the same time. Let me look.

Researcher: I'm going to be in Worcester. How close that is? I want to

Participant #2: be there the 27th through the 29th.

Researcher: I might see you flying

Participant #2: out. You said to the 27th you're there?

Participant #2: Yep. Oh, I don't get there until the nighttime of the 27th, like nine o'clock at night.

Researcher: Gone

Participant #2: by then. Dude, we just passed each other freaking like ships in the night.

Researcher: How cool is that? You get to hang out with Jeff Souther, like the scrum king. I know.

Participant #2: I told Alyssa I'm bringing like microphones and cameras and I'm just gonna be like obnoxiously recording shit the entire time.

Researcher: Dude, that's going to be awesome.

Participant #2: Jeff told me it [01:25:00] was the first day, the night of the first day I met him, we weren't drinking at a, we're in a restaurant having dinner drinking. He was drinking wine and we're just chill talking. And he leans over and he tells me, it's like, organizations are going to treat you like they're going to come after you like antibodies on a virus, and they're going to try to eliminate you from the organization as fast as possible.

Participant #2: He said, be careful because there's always going to be forces working against you and he even helped to develop the scrum pattern. To how to deal with resistance to change. And it's fascinating. It's all based on like human biology and, uh, you know, by virology and stuff like that, it's, it's so smart to recognize that something just different about how I think,

Researcher: I think that's common for change makers.

Researcher: I think a lot of change makers get gone after.

Participant #2: Yeah, exactly. But we were needed, [01:26:00] man. And we need the other, we need the resistors too, so that it makes us even better change makers. Makes us

Researcher: work a little bit harder. Uh, find new ways, experiment with different things. Absolutely.

Participant #2: Yeah. That's been great to helping

Researcher: you with your paper.

Researcher: Well, thank you. I appreciate the time very much. And even the extra 15 minutes that you've given me.

Participant #2: Yeah, I'll, I'm going to play with that, uh, Opus clip thing and we'll see what, uh, what trouble I can get into with

Researcher: it, dude, it's super simple. You paste a link. You let it go and you can leave and it'll email you when the clips are ready.

Researcher: It takes 10, 15 minutes and you pop in there. You'll have five or six different clips. I think you can set some like parameters around what kind of clips you're after on those keywords, time, that sort of thing. So yeah, boy, man, I look forward to, uh, seeing them on LinkedIn.

Participant #2: Awesome, man. Go get your rent, take your medicine.

Researcher: Yes, sir. I'm on my way there now.

Participant #2: Talk to you soon.

APPENDIX D

Interview with Participant #3

Participant #3

Hoots: [00:00:00] Oh yeah, you'll be, I'm quite confident of that. Uh, so I'm hitting, I just hit record. Um, you ready? I'm ready. Sweet. So can you please provide an overview of your experience and background in implementing Lean Principles on a construction project?

Participant #3: On a construction project? Yes. So I have been with Jay Dunn Construction for.

Participant #3: Just under seven years now, I started in January of 2017, started as senior lean specialist in Kansas city, now lean services manager of JE Dunn. And in that time I have helped, uh, train, facilitate, and coach last planner system with our teams, 5S, 8Waste across projects in education, K 12. [00:01:00] Healthcare, data centers, military hospitals, high rise residential, commercial office space, and a variety of other projects that I'm probably forgetting at this point.

Hoots: Nice. I love it. And you had some experience with lean before construction, right?

Participant #3: I did. So before coming to construction, I spent about nine years in manufacturing. So my degrees and Industrial and manufacturing systems engineering. So study the Toyota way in, in college, uh, six Sigma Deming's 14 points of management and started out as a process engineer for Procter and Gamble making Pampers and Loves diapers and, uh, leading their IWS program, integrated work systems, um, did various roles [00:02:00] through Procter and Gamble, um, from project, uh, process engineer leading the center lines, the preventative maintenance, all the way up through operations manager, leading all of crest toothpaste packaging for North America.

Participant #3: Um, and then transitioned over to Unilever where I led their world class manufacturing process, which is their version of lean, uh, for their spreads facility in new century, Kansas. Gotcha. I appreciate that.

Hoots: Um, how about, can you give us just a quick overview of J. E. Dunn?

Participant #3: Yeah, so J. E. Dunn, um, general contractor.

Participant #3: We've been in business now for 99 years. Um, you might want to fact check this, but I think at last check, we were the eighth largest general contractor. Um, we have offices all across the country. We have four regions. [00:03:00] Um, we build, as our owners like to say, we build everything, but houses and bridges and large sale commercial, large scale commercial construction.

Participant #3: We have healthcare divisions, federal divisions, data center divisions, a division for manufacturing, um, aviation, general construction, education, healthcare, which I think I said already. So we do all large scale construction, general contractor. We also have self performed divisions for, um, carpentry, masonry, concrete.

Participant #3: Low voltage and drywall.

Hoots: Nice. That was huge. Um, how much, what about revenue, total revenue? Do you know? Annual?

Participant #3: I don't know off the top of my head. Gotcha.

Hoots: Okay. Um, how about a quick overview of the company's lean journey? [00:04:00]

Participant #3: Yeah. So our lean journey started in 2012. We had two projects down in our East region, out of our Atlanta office.

Participant #3: One was a healthcare IPD project. And one was a manufacturing facility that we were building on the healthcare IPD project. We sold to the owner that we knew what we were talking about with lean. And within our first meeting with the owner, they called our bluff and said, you all need to go hire a consultant if you want to continue to work on this job.

Participant #3: And then at that same time, we were doing a manufacturing facility And one of our trade partners had just come off of a job where they use Last Planner System. And they said, hey, if you guys will buy into this or implement Last Planner System on our job, we will pay for the consultant to come out to this job.

Participant #3: We ended up [00:05:00] using the same consultant for both of those jobs. Um, and ended up, Really making really nice fee on all those jobs. The IPD project, the owner, our major trades, we all made well and above. What our contract contractual fee was. So decided to dig into lean more. We hired that outside consultant full time to JE Dunn, and they became our national lean director.

Participant #3: And over the next five or six years, we expanded across the country. We had, uh, hired lean specialists in our region, started, um, our leaders made the expectation that last planner system would be done on every job. So we really started with. Focusing on last planner system and even more specifically poll planning, weekly work planning, daily stand up to try and get all of our jobs across the country on the same page.

Participant #3: And that we did that [00:06:00] up through about 2018 or so 2019. And since then, we've been focusing on continuing to support last planner system, but also getting into our building high performing team programs, uh, putting more emphasis on 5S. On eight ways. We're exploring tact planning on our jobs now. Um, so trying to stay at the cutting edge of what lean can be for construction.

Hoots: Nice. Thank you. That was cool. I didn't know that. So your first two jobs were successful?

Participant #3: They were. They were nice. I won't say, I won't say the name of the consultant, but you know who it is. Yes.

Hoots: Uh, will you, so can you share some examples of lean culture in your organization and how they were developed?

Participant #3: Yeah. You know, so our tagline at, at J Don is that we exist to, [00:07:00] um, Enrich lives through inspired people and inspired places, which is a great tagline and we boil that down in our lean construction motto to continuous improvement and respect for people are the two pillars that we build everything on. Um, so continuous improvement, you know, just from a last planner standpoint, for example, we started out in the beginning and we would try to pull plan an entire job in an eight hour session.

Participant #3: And as many people in the lean world know that can be very challenging, exhausting, and maybe not as valuable as we intended to be with setting out to do pole plans. So over the course of our journey through continuous improvement, um, retrospectives on what has provided value, we call them do again, do betters.

Participant #3: I know Um, plus deltas do more, do better is that J done? We call them do again, do better. But at the end of any one [00:08:00] of our plans, at the end of our milestones throughout the job, we look at what went well, what provided value, what should we continue doing, what didn't go so well, what can we change up and.

Participant #3: The continuous improvement on poll planning specifically, you know, we've got them down from eight hours to now we break our poll plans into two sessions.

We have a 30 minute intro with all of our trades and our project teams to say, okay, this is the proposed flow. Let's poke some holes in it. Let's find the right size area.

Participant #3: Let's find the right manageable chunks and align on where, how everyone is going to break down their plans. We come back three or four days later and spend two hours actually diving in to the poll plan itself. And what's amazing is we've been able to take our trade partners, some of our internal people [00:09:00] leave or had terrible experiences with poll planning five, six years ago, who said they would never pull plan again, who now they won't plan a job any other way than getting their trades involved, our trades throughout our country.

Participant #3: Um, We've heard them say that, you know, they, they've never had,

Participant #3: like I said, that they have been part, didn't want to engage in them, but they come out of the whole plans. I'm saying that they really found a lot of value in it. They feel like they've been, they've been hurt. Their input is, is being taken account and not going for eight hour or four, four hour marathons are very appreciated for them.

Participant #3: So that's one example of how we do continuous improvement throughout our process. And then respect for people is what we're really starting to focus on big in our lean [00:10:00] journey at JDUN through our building high performing team program. So at a minimum, we start our projects off with a disc assessment and that's everybody who is on, um, if it's a design build or IPD project, we're going to include the owners, the architects, the major trades.

Participant #3: If it's just a larger Jade on project, we may do it internal. But whoever we deem the stakeholders of that, we will start with the disc assessment and a disc debrief to make sure everyone understands their working styles and communication styles. Then we'll do what we call our team player cards and go through some icebreaker exercises of you get the best of me when you get the worst of me when this is what I bring to the team and really start to.

Participant #3: Open up those lines of communication and build that relationship amongst the team members and help us to accelerate through that storming phase of team building, we will [00:11:00] then, uh, sit down and have a discussion around our conditions of satisfaction for the project, both what are we trying to deliver to our customers?

Participant #3: And our customers can be our owners, our trade partners, our end users are the community at large. If we're looking at a hospital or something like that, but defining success beyond. Just our quality schedule and budget, but looking at how are we going to make sure we're really delivering on work life integration for our team?

Participant #3: How are we going to deliver on, uh, problem solving? What does that can look like? Um, and we also assign our and come together on our rules of the road. So how are we going to communicate? How are we going to make sure everyone gets to take their vacation? How are we going to, um, break down this, this project?

Participant #3: So we start that at the beginning of the project and then quarterly throughout the project, sometimes more frequently, but at a [00:12:00] minimum quarterly, we do a team health assessment that is based off of Patrick lunch. Yoni's 5 dysfunctions of a team and we check in on how are we doing on those 5 dysfunctions and how are we delivering against our conditions of satisfaction and rules of the road?

Participant #3: And do we need to. Make any updates. Do we need to adjust our plan? What do we need to do to make sure that we are delivering on those higher performing teams and making sure we're, um, providing the best possible, possible place and teams to work for our people.

Hoots: Nice. That's, uh, man, I'm learning all kinds of stuff right now.

Hoots: That's incredible. Oh,

Participant #3: that was a lot of information right there.

Hoots: Yeah, no, I got, I think I got most of it. Um, thank you. Uh, absolutely. So how, how often have you seen lean fail on a construction project?[00:13:00]

Hoots: Actually, before I do that, how do you define a lean construction failure? Let's start with that one.

Participant #3: Yeah, I would say in my work, in my opinion, a true lean construction failure is when we give up. We're going to make mistakes. You know, we always say that lean is not something you can copy and you can't take.

Participant #3: The way you implemented last planner system, exactly the same way from one job to the next, even if you were to build the same job and we've done, you know, re repeat jobs, repeat clients, but they're done at maybe different time. So pre COVID or post COVID, or they're done in different states or they're done in different cities, and there's always a different set of circumstances, whether it's the superintendent, the project manager, the trade partners, the.

Participant #3: procurement or escalation environment that, that you're in, you're never going, you're going to follow [00:14:00] the same principles of, you're going to have, you

know, we're going to start with last planner system, five S eight ways. And we're going to start with having a milestone plan. Plans, weekly work plans, daily stamps.

Participant #3: But even in those weekly work plans or daily standups, they're not going to look the same. Some teams really, we do a sticky notes on boards, six week look ahead, sticky note boards. Some teams prefer to do that in Excel role a lot for our projects now where they would prefer it to be in mural. And some teams, we use a laminated floor plans and dry erase markers and they color on them where they're going.

Participant #3: So. The conversation may remain the same of where are you headed? What's standing in your way? What roadblocks and constraints do we need to figure out and navigate to make sure we can deliver the plan? But how and the tool we use to communicate that will be different on every site. [00:15:00] And a true lean failure, in my opinion, is when we give up instead of tweaking the plan and say, well, maybe that's not the right tool, or maybe this isn't the right time, or maybe, you know, PDCA, Plan, Do, Check, Act through it and figure out how can we make this to work, make this work.

Participant #3: And I tell my project teams that my job is to make lean work for you and be effective for you, not to make you work for lean. If it feels like you're doing more work because you're doing last planner system or that it's frustrating, then we are doing something wrong and we need to, uh, Call a timeout. We need to throw, throw up that flag, declare a breakdown and do a retrospect and say, what's working well, what's providing value and what can we do differently?

Participant #3: And as long as you're continuously improving, I don't see it as a failure. It's when you give up that it's a failure.

Hoots: Yeah, that's huge. You're actually the second person to say that, uh, Jesse Hernandez defined it that way [00:16:00] as well. I love Jesse. Yeah, he's a good dude. Uh, so how often have you seen lean construction

Participant #3: fail?

Participant #3: More often than I would like to admit. Um, and I would say that has changed in the past couple of years, um, where we have gotten beyond the giving up. But when I first started, we had, I had superintendents and project managers that would tell me that they, they don't have time to do lean on their job.

Participant #3: They, they don't have time to do pull plans because the pull plans never worked anyway. They've never been a part of an effective. pull plan. So why am I even going to try or I can't get my trade partners to, to give me any information. So why am I

even even trying? Um, we've, and I would say back then it was [00:17:00] probably 50, 50, maybe even a little higher on the failure.

Participant #3: And we've done a lot of work through, we call it our lean leadership series. So, Um, every, I run an eight week cycle with our senior project managers, senior superintendents and above. And as people get promoted, I roll new people through, but it's an eight week series that's based off of the lean builder book, which you know, very well.

Participant #3: And we read, so we read, for example, the first chapter on daily huddles, and then I will tie that into also a respect for people principle or a, um, maybe not just specific lean construction example. So I tie daily huddles into, uh, the book, turn the ship around and leading with intent. And. Why do we have daily huddles?

Participant #3: Well, because we want to push the decision making down to where the [00:18:00] information lies into our foreman, into our last planners and engage them in the best way to plan our work. So trying to connect the, the lean construction principle with just a leadership principle or a psychological safety principle or a human connection principle, um, and.

Participant #3: Going through that, going through those classes. And we've been through maybe, uh, a dozen cycles with that or so. Um, I have some of our general superintendents that people told me would never, ever buy into lean that are now some of our greatest supporters of find something that's going to work for you.

Participant #3: Find that 1 percent better that you can do. And let's continue working on improving, not making sure we're filling out a weekly work plan exactly the right way. I think if you take that approach of let's figure out how to make it [00:19:00] better, our failure rate and our give up rate has gone down exponentially.

Participant #3: I maybe have a handful of people now that I can't go talk to in their office where they're, they just tell me I don't have time for lean. Those are few and far between now.

Hoots: That's a good feeling. It is,

Participant #3: it is. And you know, we started defining our levels of implementation of lean, uh, We have like a five point scale that we're using to kind of judge our jobs now. So zero is they're not doing anything. Uh, level one is they're kind of starting to engage in some of the tools. So maybe they're doing daily Santa's weekly work plans, but they're not, they haven't fully bought in, but they are on the road to improving.

Participant #3: Uh, level two means that they have a coach. So they're not just trying to [00:20:00] do the tools on their own, but they're actually. engaging with our lean team, with our coaches and trying to figure out how they can improve instead of just using the tools level. Uh, one is using tools to is what the coach level three is going to be.

Participant #3: They're actually, um, using the building high performing teams. They're doing their team health assessments. They're actively involved with their retrospectives. Level four. They're actually going to be looking beyond just. Are kind of our average normal last plan, our system building high performance teams, but we'll be doing study action teams with them where we may read books like the coaching habit or the ideal team player or how big things get done or and kind of look out for those next big things, um, reading, elevate construction and how can we implement tact.

Participant #3: And then level five would be a full on target value [00:21:00] delivery, IPD type project where it's not just even JDUM, but we're bringing our owners, our architects, our trade partners, everybody is involved in those study action teams and looking for what's better. And, and we're really trying to figure out how can we do this differently?

Hoots: How often do the projects get scaled?

Participant #3: Um, so we, um, update them and review them once a month. So once a month, we go through all of the projects that we're supporting with our regional leadership. So we're, we're broken down by regions. I said earlier, so I'm in the Midwest region and actually right before this call, I did my update with our direct director of construction operations and our Midwest president, and we'll review.

Participant #3: Um, where we're at with our projects, what level of implementation they're at, [00:22:00] what's going well, maybe if we have some challenges that we need, you know, some of that extra persuasion from the leadership level, we can ask for that help. Um, but it's really an open conversation of, you know, how are we supporting our teams, and then how can leadership support us as the lean group?

Participant #3: And we do that within every, every region. And once a month, the, the jobs will get a level of implementation and they can level up or they can level down if they're starting to disengage, um, and then we'll also, uh, give them a kind of red, green, yellow on where they're at from, you know, team health assessments from implementation of tools from schedule, things like that.

Participant #3: Gotcha. And that's a relatively new process for us. So we, the metrics thing really came about after Congress last year. Um, and we saw [00:23:00] what, I think it was Jen Lacy, what she was doing with her projects and how she was really

tracking her, her metrics. And so we, uh, shamefully or shamelessly, I should say, stole that and, and started trying to put metrics to our jobs.

Participant #3: Um, so that we can actually show the real value that lean is providing for our hyper

Participant #3: for our T. R. I. R. for our, um, warranty and, uh, quality claims and we can actually track with our level of implementation. Now, the higher our teams go in their level of implementation. So when you get start getting into that 3, 4, 5, T. R. I. R. unplanned attrition. Quality claims drops off significantly.

Hoots: Interesting.

Hoots: Um, okay. What, what are, so let's get back to lean [00:24:00] construction failures. Uh, what would you say are the most common reasons by lean construction fails on the first implementation?

Participant #3: So I would say it is, um, not under, not having the mindset of the continuous improvement and really. From what I've seen with a lot of our projects is it's a mental block of why it won't work instead of figuring out what can we do to make it work. I'll tell you one example of I had a superintendent who was on a job in a small town in Southwest Missouri and he went into it with the mindset that his trade partners were going to be unsophisticated because of where we were working and he was trying to go through the motions of Daily standups and weekly work plans, but he just kept coming back to [00:25:00] me and saying, these, these, these guys just don't know how to plan.

Participant #3: They're just unsophisticated. They're, they don't know what they're doing. And I said, well, I kind of refuse to believe that because we're building some great buildings, so these guys obviously know what they're doing. So let me come down and let's, let's look at what's going on. And he said, okay, come on down.

Participant #3: And so I went and I, I observed a daily standup. And I observed specifically an interaction of this superintendent with the, with the electrician on site who I actually had worked with at a previous job. So I knew the electrician pretty well too. And the superintendent said, Hey, how's, how's punch list coming?

Participant #3: Are you, are you guys getting, are you guys making progress? And the foreman said, yeah, you know, we got, we got a couple of items done yesterday. We're working on some more today, but yeah, we're, we're chunking it [00:26:00] off. Superintendent said, okay, this was on a Friday, by the way. He said, are you working this weekend?

Participant #3: And the electrician said, no, I don't have any guys playing this weekend. Superintendent said, okay, okay. Hey, are we, we've got those parts coming in today, right? Electrician said, yeah, I've got two guys runs the shop. They'll be back in about 45 minutes. He goes, okay. They moved on to the next person. And then after the, the daily standup, he comes, he goes, see, I can't get these guys to tell me anything.

Participant #3: I said, I told my superintendent, I said, what are you talking about? He answered every one of your questions. If you didn't like the answer that you were getting, he thought, he thought he was answering all of your questions. He doesn't understand that you're frustrated with them because he answered everything, you know, you asked him how many, or you asked him if he was getting, making progress on his punch list.

Participant #3: And he said, yeah, if you want to know how many items exactly he had done, you know, is he. [00:27:00] 20 of 50 done? Is he three of 10? Is he zero of whatever? Ask that. Okay. So how many, how many have you gotten done? How many are on your list? If that's the level of answer that you're looking for, ask that question. You asked him if he was working this weekend and he said, no, I said, do you need him to work this weekend?

Participant #3: He said, well, yeah, it would be really great if they were here. Well, is that a follow up conversation that we could have had. Um, you know, and, and we just kind of talked about that. We brought it back to communication styles and you know, a lot of the time, those frustrations and those it won't work comes from a lack of clarification or misaligned expectations, or even just a mental block.

Participant #3: He had it in his mind that these were unsophisticated trade partners and they weren't going to be able to plan. And he wasn't even giving them the chance to rise to the expectation. So I tell my project teams and my superintendents [00:28:00] on the failure part of it, that you get what you accept, not what you expect.

Participant #3: So you have to be clear on your expectations. And if you let people, or if you accept, you know, one word answers, then people are going to get by with giving one word answers and you're going to be frustrated until you address it. So I would say our failures generally stem from. Mental blocks more than anything.

Hoots: Gotcha. I call that uncommunicated expectations.

Participant #3: Exactly.

Hoots: I've got a big problem with that. Sometimes, uh, I'm working on

Participant #3: it. And that, that's what we're trying to work on with our building, high performing teams and conditions of satisfaction rules of the road. You know, they're really kind of published expectations are of how are we going to communicate and interact with each other and treat each other with that.

Participant #3: Respect and [00:29:00] help each other grow.

Hoots: That's what it's all about. And so,

Participant #3: um, I would say one other kind of major failure that I see, and it still goes back to that expectations. But when we, as the GC fail to prepare and also fail to prepare our, our trade partners, for example, going into a poll plan, I said, we've, we've, we've We've done

Participant #3: more two part process and we used to get into a pole plan and say, all right, we, we would have an email going out saying, all right, we're going to plan this milestone. We're going to plan from, you know, ready for drywall back through, uh, you know, kind of structure complete. So we're going to do framing in wall roughing and things like that.

Participant #3: And we would just go straight into the pole plan and we would spend the first hour. Hour and a [00:30:00] half of a, you know, three and a half, four hour bull plan trying to align on, well, what does that really mean? What areas are we looking at? What work do those trades have to do? And then we would go right into writing sticky notes when people may not have even prepared.

Participant #3: And so we're trying to just come up with our best guess there in the moment and then start to try and do a pull plan. And they, they were disastrous, right? I mean, they weren't accurate at all. So that's what we can do differently. Let's spend how we get to ready for drywall. Let's spend some time going over.

Participant #3: This is the proposed flow. This is what we're this is what we're thinking. I had 1 job in Oklahoma that we were looking at. Footings and foundations complete, and originally we had three areas, level one, level two, level one C, and just in that [00:31:00] initial proposed flow and trying to make sure we were breaking the areas into the right size, um, sections.

Participant #3: I don't want to use tack line, it's because we weren't doing tack, but we were looking for those right. Right sizing our areas, right? And we ended up breaking out so we could plan more efficiently to find our handoffs better. Level one became level

one, a, b, c, d level two became level two, a, b level one, c became level one, c, a level one, c, b.

Participant #3: And then we gave the trade partners a week to go and really study their drawings, understand what work do I need to have in here? What is that truly going to entail? What's the duration? And then when we came back and we did the actual pull plan, I think it took us about 45 minutes to plan, you know, 120 days worth of work because we had done the prep and the full plan was, That much more efficient.[00:32:00]

Hoots: That's a great example of planning, uh, to make it easier doing the work now to make the work easier later. Uh, all right. Can you share some examples of lean tools or techniques that have been successful in improving project performance?

Participant #3: You said,

Hoots: uh, can you share some examples of lean tools or techniques that have been successful in improving project performance? The first project. Yeah.

Participant #3: Yeah.

Participant #3: Daily standups. If I can get my, my project teams doing anything, if I get them starting anywhere, it's daily standups, not even full on last planner system. Cause the second we can start getting trade partners and our [00:33:00] superintendents and everybody in the room for 15 minutes, once a day to just say, this is what I got done yesterday.

Participant #3: This is what I'm working on today. And this is the help that I need. Right. We changed the dynamic on that job site of everything coming through the general contractor, through the superintendent of the superintendent going and chasing down everybody throughout the day, you start to open up the lines of, you know, the electrician maybe needs something from, from the framer instead of us playing the telephone game of.

Participant #3: You know, Joe, the electrician calls us superintendent and we have to go then track down Bob, the Bob, the framer. And then he's got some other constraints and we haven't talked about them. And you end up talking in circles, just getting people communicating for 15 minutes every day will increase your reliability, increase [00:34:00] your, your production and throughput exponentially on your job, just by having a simple conversation.

Participant #3: If I can push any of my teams to do one thing, it is to have a daily stand up.

Hoots: Beautiful. Thank you. Um, who do, who do you engage and involve in the implementation of lean construction on the job?

Participant #3: So. The way that we generally do it is we engage with a, we assign a lean champion or identify a lean champion on that job.

Participant #3: Um, so that could be the superintendent. It could be a project manager. It could be, um, a field engineer. What that lean champion is though, is our point of contact for. Really, um, scheduling our, our trainings, our meetings, uh, looking at [00:35:00] capacity is our lean group. We support projects nationwide and we're each one of us is probably supporting, you know, at any given time, 10 to 20 projects.

Participant #3: So we work through the one lean champion to get onsite. Once we're onsite, we're really communicating with the. Superintendent, the foreman, uh, trade partners, and then depending on what other meetings we may engage the project managers, but we're really focusing on improving the communication between our foreman, blast planners, and superintendents.

Hoots: Thank you.

Hoots: Did you experience any or have you experienced any resistance to the initial implementation of lean? And if so, what did it look like?

Participant #3: All the

Hoots: [00:36:00] time,

Participant #3: all the time. Um, and a lot of it still comes from, uh, well, I'd say I have, I have two main points of resistance that I see. Number one, from bad experiences, On poll plans or last plan or jobs from five, six, seven years ago.

Participant #3: So early implementation, when we didn't have a lot of support and we haven't, uh, what we've learned over the, over the years through continuous improvement, right? So some people had really bad experiences at the beginning and they wrote it off. Um, and those are the people that I really like engaging with because we, I just started the conversation of what is the one thing that we can work on improving.

Participant #3: Well, ideally we'll get to full, uh, lean implementation. And I have you as a, as a lean champion and you're going out and saying, you're never going to do a job [00:37:00] differently, but first let's start on one thing that we can improve. What is one thing that's frustrating you and let's find the right tool to solve that.

Participant #3: So we see pushback from that. The other pushback that we see is, you know, Jay Dunn has been around for 99 years and we have a lot of superintendents and project managers and project executives who have been around for 20 plus years, who. Maybe don't see the need to, to change or to improve because they've been successful for so long.

Participant #3: Those are the ones that can be a little bit harder to, to change. Um, but luckily, you know, the Lean Builder book gives me a great story about sharpening your axe that I, I like to point out to, to those, um, kind of more senior individuals. And the other thing that I, I point out to them is that it's their responsibility to grow our, you know, [00:38:00] our up and coming foreman and, uh, superintendent ones and superintendent twos.

Participant #3: And if we all. Are starting to implement our jobs in a consistent manner. It doesn't matter who you grew up under or what the phrase is. And Jay done is you run your job based on who your daddy was or who your general superintendent, when you came up was, we can take that away because it doesn't matter if your foreman was working under, you know, superintendent a, and now they're moving over to a different job in a different, you know, vertical and they're under Superintendent B.

Participant #3: They don't have to learn a whole new system. We know it's expected consistently and with our labor shortage right now, we have people moving between jobs. We have people moving between offices, region, states, and we shouldn't have to learn a new system and communication style, our communication tool.

Participant #3: Every job we go to, we should know that daily standups, weekly work plans, poll plans, the way we deliver our [00:39:00] work is going to be consistent across the country.

Hoots: Thank you. Love it. I feel the passion too. Um,

Hoots: can you share any innovative approaches or technologies that you've used to support first time implementation of Lean principles?

Participant #3: Man, I don't know that we've really done a lot of innovative techniques. I know we had to change the game, obviously, when we all had to go remote. That's when

we really, really bought into Mural. Or Miro or using those kinds of online whiteboard tools. And we haven't looked back from those. We continue to implement them.

Participant #3: We continue to use those to, uh, collaborate across different regions across, um, even, even if we're on the job site in the trailer together, doing a poll plan, we prefer to [00:40:00] do them in mural because we leave with a PDF record and you can drop drawings in there and. You know, we've tried out different softwares.

Participant #3: We're working on a lucent, we've used touch plan. Um, some jobs really like it. Some jobs really don't. I think when it comes to software, it can depend on the users and the team that, that is using it.

Participant #3: We've had some projects really, really, really buy in and love the software. We've had other teams that just say it's too cumbersome and it adds too much work. And. One of those things, you know, if lean feels like it's adding work, then we're doing it wrong. So we will go away from the software to make sure that we're focusing on the conversations and the implementation, not necessarily the tool.

Participant #3: So, um, I, I can't say we've had consistent with, with the exception of mural. I don't know that [00:41:00] we've had consistent innovative type approaches cause every job's a little bit different. Does that make sense?

Hoots: Yeah, definitely. I like the online whiteboard reference. So that's a good one.

Participant #3: Yeah, those, those are awesome.

Hoots: Agreed. So what advice or recommendations would you give to organizations looking to implement lean principles for the first time?

Participant #3: Yeah. Um, I would say focus on the people, number one, and that's topped about, you know, you hear all the time that, uh, you can't have a full lean implementation without top down support. Which is true. I mean, the leadership needs needs to be bought in, but there's a difference between having leadership bought in and then going out and telling everybody that that's, this is what you need to go do versus having leadership being [00:42:00] bought in leading by example, you know, looking for ways to improve being vulnerable and admitting their mistakes and just leading by example of the mindset that you need for lean, not just saying, Hey, We're making a lean transformation.

Participant #3: Every job's going to do last plan our system. Go do it. That is leadership support, but that's not leadership support. That's going to get you a lot of, a lot of places.

So you need to focus on the people. What is, what's in it for them? How is it going to make their jobs easier? How's it going to benefit, um, kind of each person and use tools when it makes sense.

Participant #3: So just like you're not going to drive a hammer, you're not gonna use a hammer to drive a screw. Don't force the tools into situations when they're not being effective. Find the problem and then work your way through the solution. Plan, do, [00:43:00] check, act. Make those small adjustments. Make those small changes.

Participant #3: Change the plan when it's not working. Admit when you've, uh, a plan hasn't gone the way that you wanted it to. And talk through what you're going to do differently. But if you focus on the people and the mindset of lean, not the tools, you will be much more effective in your implementation.

Hoots: I freaking love that advice. That's awesome.

Hoots: So based on your interactions with various project team members, what are their views of lean construction after an, after an initial implementation?

Participant #3: Yeah, they. If I've done my job correctly with them, they see lean [00:44:00] as last planner system or not just pole planning. They see it as a mindset and a way of, of thinking of I'm, there's something that is frustrating me.

Participant #3: I have the power to try to make the change. You know, I can, Come up with a hypothesis. I can test out my theory and make adjustments as necessary to make it better. But I don't have to, I tell my teams all the time, if you're in a meeting that you have every week or every other week, like an OAC or a forums meeting, and you don't want to be there, or it's frustrating, you have the power and the ownership to make that meeting be effective for your job.

Participant #3: So. If I've done my job correctly, people don't just see lean as the tools. They see it as the intentional improvement and focus on making things [00:45:00] better. And then they're fully bought in on, on to lean.

Hoots: All right. What do you focus? Oh, go ahead.

Participant #3: I was, I focus pretty high up on that abstraction tree from this is lean levels of distraction.

Hoots: Oh yeah. The fruit. Oh yeah.

Participant #3: Yup.

Hoots: Um, What do you think the industry, the construction industry's perception of lean construction is?

Participant #3: As a whole, I think the, at least in where I've been working, so I can't necessarily speak for The entire industry, because I've been focused mostly in the Midwest. And what I've seen is most of the reluctant reluctance that we've seen for lean is really more in the reluctance to last planner system and people feeling like, why am I doing these poll plans or these weekly work [00:46:00] plans when no one's listening anyway, and that lean has been a check the box.

Participant #3: And I've heard a lot of people say that they thought lean was going to be a fad, just like lead or anything else. And they've just kind of been like, yeah, I'm going to do it and bide my time until this, this blows over. And we have more and more of our, um, trade partner, superintendents, project managers that we've been working with that are starting to realize that lean's not going anywhere.

Participant #3: And that when we do look at improvement, when we do Properly prepare for our poll plans. When we do truly engage our people in the field through weekly work plans and daily standups, that there is a lot of value value in it. So I would say the early perception that I heard of lean is that it was going to be fat and it was going to blow over and we're just going to bide our time.

Participant #3: But that has definitely changed over the past [00:47:00] couple of years.

Hoots: Gotcha. Uh, what does it change to, do you think?

Participant #3: I have, I have trade partners now that we work with. Regularly in Kansas city or in Omaha that they are asking right away. Is the job going to use last planner system? Cause they've seen the value in, uh, collaboratively planning through poll plans or through weekly work plans. They've seen the, the difference that are building higher performing teams, jobs, the way those, the culture is in the jobs, the way people, um, Are proud of where they're working.

Participant #3: There's a, just a different feeling when you work on one of those job sites. It's not one of the, we've had some jobs that we've just come off of recently where you can tell no one wants to be there. There it's a grind. [00:48:00] It's the attitude is let's just get this finished. And I hope I never have to come back to this job site again.

Participant #3: We have far less of those jobs now, and we need to have many, many, many more. Are many less jobs like that, because as I said, our industry, we don't have enough people to do the work. We need to make sure that we are elevating our people with that. We're making sure they're doing the things that they need to do, not doing wasteful work, not doing extra work, and that they feel valued and that they are doing meaningful, meaningful work.

Participant #3: And I, I really do believe that lean Focusing on the respect for people. Part of that is changing that, that perception. And we've seen it with our trade partners. They want to be on jobs that are utilizing high performing teams that are utilizing last planner system.

Hoots: Gotcha. Um, [00:49:00] okay. What are, what are the factors that you think play into, well, we kind of answered that.

Hoots: What do you, what are the factors you think that play into lean construction, first attempt failures,

Participant #3: trying to, trying to copy. Or go through the process of, I know that I, you know, someone told me I have to do a pull plan. Someone told me I have to do a weekly work plan. And I have this form that, you know, someone set out and just, and trying to not understanding what you're trying to accomplish, but trying to figure out how to use the tool.

Participant #3: So when you focus on function, Now, if you focus on form over function and making sure you're, you're doing something exactly the right way, it can be really frustrating. Um, and will lead to failures and giving up and saying, this just doesn't work. When, [00:50:00] if you're not spending the time to understand, well, why are we trying to do this?

Participant #3: And is there a different shape that it could take? You know, a lot of our first run failures and, and lean came from, you know, not understanding you're, you know, trying people would come in and say, Oh, you're, you haven't filled out this weekly work plan correctly. Cause you don't have the area filled out in the manpower and you haven't checked this box and that can be, that's disheartening to people instead of saying, what are we trying to accomplish in a weekly work plan?

Participant #3: Well, I need to know where you're working, where I'm working. How can we, how can we set the next person up for success? How can we manage these handoffs? And the tool becomes a different thing. So I would say your first run failures generally are due to trying to force the issue, force the tools instead of forcing the understanding of why.

Hoots: Perfect. Thank you. Um, two more. Can you please list and rank the five most important factors that contribute to the [00:51:00] success of lean construction on the first attempt?

Participant #3: Oh, that's a loaded question. Um,

Participant #3: list and rank the five most important factors.

Hoots: That contribute to the success of lean

Hoots: Yep

Participant #3: Um,

Hoots: and I can if you want to think about it. I can email this question to you

Participant #3: Yeah, I might have I might have to think about that one.

Participant #3: That's a really great question though, by the way

Hoots: I like that one. Thank you i'm going to take and combine, uh, The three that I have and then have other people i'm going to send all this out in a survey and then have other people Rank them as well. Um, [00:52:00] Do you have any other thoughts or opinions on the root cause of failure for initial implementations of lean construction or people's perception of lean construction?

Participant #3: Uh, you know, I think one of the, and I'm going to butcher this completely because I don't have it in front of me, but I, I constantly go back to the, The systems thinking workshop that we went through, and that has completely changed my perspective of how to go about organizational change and help me out remembering the two different types of loops.

Hoots: Of the reinforcing loop and the balancing,

Participant #3: the balancing loops. Yes. And going through and on that, that dance of change and, you know, talking about the, the understanding [00:53:00] of why and the, the small wins and how that can reinforce and let's just focus on the little things. And, but then you have the balancing loops of, you know, Simple things of, again, well, you didn't fill that out correctly.

Participant #3: Well, those little things will also knock you down, down the list. And how can we really build the reinforcing loops and how can we mitigate those, those balancing loops? And how can we make sure that we're, you know, you've got your personal growth and you you're curious on how can I get better? And then that expands out to your team.

Participant #3: And then that expands out to your organization and from all different levels, you know, that's part of where our lean. Our lean leadership series came from let's focus on getting personal growth. Then you can expand that to the team and then that'll grow through the organization. And, uh, I, I think that was one of the biggest, honestly, one of the biggest things that unlocked and got me unstuck from, you know, cause I wasn't a place where I was like, man, I [00:54:00] just feel like I'm doing the same thing again and again and again, and I'm not getting much different results.

Participant #3: And you start to kind of start to get into that. That cycle of, am I actually providing value? But once you start looking at it from those different reinforcing and balancing loops, and there's a bunch of them in that book, that unlocked my mind.

Hoots: Yeah, I just sent you, um, Donella Meadows did what she called leverage points on systems.

Hoots: Have you seen that?

Participant #3: No, I don't think so.

Hoots: Oh man. I just emailed it to you. It's a link, uh, to an article with, uh, they have like the system on one side and a full on a fulcrum, and then they have listed out like all the things you can do in order to affect or change the system. And you'll see physical events is like super close to the fulcrum.

Hoots: So you get no leverage there, but that's the one we always try versus going to mental models and mind shifts, [00:55:00] which is on the outside. Anyway, take a look at it. I think I think it would be good for you. Um, what else? What else should I be asking? I missed any obvious questions you can think of.

Participant #3: Um,

Participant #3: no, you know, I think,

Participant #3: I think one thing that every lean practitioner or should be thinking about whether you're in the, you know, you're trying to change an organization, you're trying to

change yourself and, but that constant state of curiosity and learning, um, and maybe, you know, what are, I always liked the question and it doesn't necessarily go, I guess it does go with the culture change and, but.

Participant #3: If you could [00:56:00] give somebody new to lean or if you were trying to get somebody into your way of thinking, what are like three books you would give them? Um, and for me, um, especially somebody who's been in it for a long time, I always point people to, um, Think Again by Adam Grant is a great book to kind of reevaluate your, your stances or what you've always known.

Participant #3: Um, One that I've read really recently that I think every person in construction needs to read is, uh, how big things get done. Um, and then I recommend to everybody who's actually in construction and is trying to implement a lean transformation from a last planner standpoint, the lean builder really is one of the greatest superintendent resources out there.

Hoots: Amen. I agree with that. 100%. [00:57:00] Awesome. That was painless, right?

Participant #3: Yeah, I think, like I said, I hope I provided value to you.

Hoots: Oh, absolutely. A hundred percent. No question. Uh,

APPENDIX E

Interview with Participant #4

Participant #4

researcher: [00:00:00] I won't use your name unless you give me like written consent to use your name. Okay. And other than that, I'm just really looking for your experience. You're going to make my third interview, which is what will enable me to be able to put together my survey for the industry.

Participant #4: Got it.

researcher: All right. Are you ready? Yes. So can you please provide an overview of your experience and background? And implementing lean construction principles on a construction project.

Participant #4: Yes, I was introduced to the idea of lean construction back in 2000, um, experienced last planner system and [00:01:00] lean construction from the trade partner side of the business for 18 of those years, experienced lean construction from the GC part of the business for about three and a half of those years.

Participant #4: Um, and from the owner side and, and consultant side for, let's say a year a piece, um, I've had responsibility for learning and deploying it on my job site, the jobs that I was directly responsible for, I had responsibility for deploying it for a business unit, uh, with the workforce up and around 80, 90 people, um, which meant multiple job sites within the San Antonio area.

Participant #4: And multiple projects, in some cases, it was just the trades. For us, the, the mechanical contractor, some cases we were [00:02:00] able to collaborate with multiple trades. In some cases we collaborated with general contractors as well. Uh, when I was with the GC side, same thing, except the inverse.

researcher: And how long have you been in the construction industry? Since 1995 and that's a long time, but, uh, 30, almost 30 years,

Participant #4: 28, baby.

researcher: That's awesome. Um, perfect. So you have actually a unique experience. I'm glad we're doing this interview. Um, can you, so can you provide a company, I'm sorry, but can you provide an overview of the company that you work with now?

Participant #4: Yeah, I'm a independent consultant, the name of the company's depth builder. And I help leaders [00:03:00] earn trust through their improvement initiatives.

researcher: Sweet. Um, and

researcher: you've already done this one, I guess. Um, it says, can you provide an overview of the company's lean journey? Is there anything different from your lean journey? And your company's lean journey?

Participant #4: No, except that my, I guess my lean journey, uh, is what helped me specialize in the things that I specialize with in my business.

Participant #4: Can

researcher: you share some examples of lean culture in your organization and how they were developed? So maybe the [00:04:00] question for you is, can you share some examples of how you've developed lean culture in organizations?

Participant #4: That's the same answer. Um, the, the idea that the around the culture that my business is built on and what I impart with clients is that it's about learning and building capabilities, specifically problem solving capabilities.

Participant #4: And so what that really means is building a high comfort. With experimentation and figuring things out as they go, uh, instead of getting distracted with, um, Grand slams every time somebody goes up to bat. Uh, so it's really, it's really about the leader understanding there that their reaction or response to problems [00:05:00] will make or break their lean transformation.

Participant #4: If it's a punitive response. It will kill the innovation, um, the curiosity and the learning, uh, when it's a, um, supportive response, uh, it will help that curiosity and learning and experimentation thrive.

researcher: How would you define a lean construction failure? Giving up

Participant #4: giving up on on the effort.

Participant #4: So, for example, if somebody was to start a 5s program, um, and it's hard at 1st and very few people listen, that is to be expected. And so working through that, uh, the problem solving that goes with deploying that idea. [00:06:00] The, the social capital that is gained and social currency that is spent. That's all part of the thing, right?

Participant #4: Cause lean is PDCA, not D and D do excellent. It's plan do check adjust, which means it's going to be bumpy. Uh, and so in terms of what my response is giving up, you try it. It's hard. Duh. You fail when you quit, you fail when you stop.

researcher: Okay. Have you, so have you seen, or how often have you seen lean construction fail?

Participant #4: That's a difficult question to answer because the, the, what people consider to be lean construction in some cases is very deep and very rich. And in other cases, it's very shallow and, and [00:07:00] vain. Um, and so I struggled to answer the question because people are going to go broad and narrow. Um, can you repeat the question?

researcher: Yes, sir. How often have you seen lean construction fail?

Participant #4: I have seen it fail. Ah, that's okay. I'll answer it this way. I have seen it fail the greater percentage I've seen fail. And what I mean by that. Is if I count the people in the room and on the projects or within the business units or within the departments and I count the ones that have quit disengaged and just kind of went through the motions at best, those are all failures from my perspective.

Participant #4: Uh, so in my head, the failure point is, is at a granular level within each individual that quit gave up or didn't even try.

researcher: And you said it's at a greater percentage of lean construction has failed. Did [00:08:00] I get that right? I'd say people, not, not lean construction. Greater percentage of people have failed at lean construction or have failed to implement lean construction.

researcher: Have

Participant #4: failed to learn lean, learn and apply lean principles. Thank you.

researcher: How do you measure the success of lean construction within your organization?

Participant #4: Um, uh, loose. So when it's internally. It's by progress. If there's progress on a particular experiment or problem solving effort, that's how I measure success. Um, when it's leading and coaching others, it's light bulbs. [00:09:00] Uh, the number of times I see people get it and say, Oh, I can apply that to this.

Participant #4: Um, I see, uh, that's, that's the other way.

researcher: what would you say are the most common reasons? Why lean construction or people disengage with lean principles, specifically on the first time?

Participant #4: Yeah, um, one, because it's their first time and, and people have a very low tolerance for friction. That's a natural thing for anything. Um, I think the other thing is there's not agreement on the problem.

Participant #4: And so I don't know any teams that have said, we are going to [00:10:00] do this thing. I only know of individuals within a team or an organization that went to a workshop or a conference or read some white paper that came back on fire and said, we need to do this, um, but they don't know how to do it. And so. I mean, it's the equivalent of me watching a tick tock of Deion Sanders.

Participant #4: And I'm going to go hot coach a fricking college football team to a championship. Like it, no, there's so many micro skills to build and, uh, and a team to build and people to get on the same page and understand and alignment. And so people don't understand that they think it's a process and let's do the process and it's going to be amazing.

Participant #4: That's one person that brings it to the group and the rest of the group is like, what the hell are you talking about? I've been doing my job fine. [00:11:00] And so people don't have the, again, it goes back, kind of ties back to the friction. There's not agreement on the problem. They don't have the endurance to overcome the friction of change.

Participant #4: And they expect, they expect. instant return on their efforts, meaning big giant wins with every baby effort that they put into the thing.

researcher: Well, if I just said that giant wins with minimal effort. Oh, yeah. Um, all right. Can you share examples of lean tools or techniques? That have been successful on the 1st lean project implementation.

Participant #4: Yes, sweat equity improvement.

researcher: Hey, can you tell me what sweat

Participant #4: equity improvement is? Yeah, sweat equity improvement is a system that [00:12:00] maybe we'll think of it as a vehicle to apply all the lean jargon and all the lean some of the lean tools and terminology to actually. Improve work for the people that are doing the work. Um, the reason that it works the first time is because it's not like these outside avatars studying insects.

Participant #4: It's human beings getting in there and putting in the effort to make the work better.

researcher: This is a good one. Who do you engage and who do you engage and involve in the implementation of lean construction on the project? Depends on the problem.

researcher: Give me a couple of examples of different levels of engagement.

Participant #4: Yeah. So, so if I have a, if I have a production problem, [00:13:00] I'm not going to engage with the project managers and superintendents and like, they don't do production. They measure it. So if I'm, if I got a production problem, I'm going to go to the people that are producing the thing.

Participant #4: Um, if I've got a communication issue, I'm going to go to the stakeholders or the parties that are involved in the. Information that is supposed to be transferred and understand if that's happening or not. Um, if I've got an organization problem or a supply chain problem, I'm going to go to the specific, uh, manufacturer or, um, supply shop and understand what their process is to get the stuff back in time.[00:14:00]

researcher: All right. Have you experienced any resistance to the initial implementation of lean construction? And if so, what did

Participant #4: it look like? Yeah, again, lean construction is just like vanilla ice cream. What, what the hell are we talking about? Um, but yes, I have. And, and it's because people are human. That's all.

researcher: What did you do to overcome that resistance?

Participant #4: At first I hit him between the eyes with two by fours until they listened to me. And then that didn't work. Um, and then what I found that absolutely works is identify something that a pain that they're experiencing. remove the pain and then [00:15:00] explain to them what I did to remove the pain, which is a usually application

of some lean tool, um, and help them understand how it can make their day better in other areas.

researcher: All right. Um, can you please share any innovative approaches or technologies that you have used to support lean construction implementations?

Participant #4: Yeah. So both an innovative approach. And a, what's the word? Largely unused. Technology is listening,[00:16:00]

Participant #4: but that's it. That's the technology. That's the approach. Listen, what

researcher: advice or recommendation would you give to organizations looking to implement lean construction for the first time,

Participant #4: identify a problem. that is bringing significant pain to the audience. You are going to introduce two lean principles.

Participant #4: Anything

researcher: else?

Participant #4: Oh yeah. Um, do it your damn self too. Like to your day. How about that one?

researcher: This is fun. This is so fun. Oh, I love it. Yes. Just because I got such an awesome reaction from that question. I'll ask it again. Is there anything else that I should include just

Participant #4: You know, I don't [00:17:00] know if this helps at all or detracts, but I feel like getting ultra clear about what lean, what you're referring to when you say lean construction could make Right. Could make this very useful or just add it to the same pile of garbage that's out there around lean construction. Okay.

researcher: Okay. How would you recommend that I do that? Get clear.

Participant #4: Okay. Like in your head, lean construction means something. What does it mean? Or, or here's another speaking of lean shit. How about visual? How do you make what you understand lean construction to be? How do you make that visual? What's a visual representation of that?

researcher: Yeah, I guess for me, this is a really good question.

researcher: For me, [00:18:00] lean construction is three things. It's it's understanding, uh, flow efficiency over resource efficiency. It's continuous improvement and it's visualization. All three of those with the premise of we respect. So, yeah, I think if I write that down, no, not helpful. No, no, no.

Participant #4: I'm I'm nobody fucking.

Participant #4: Nobody is going to think that's what link construction is,

researcher: right?

researcher: What is, so what does lean construction mean to you?

Participant #4: Lean construction is a term that people use. When they're complaining about others, not complying with their wishes.[00:19:00]

researcher: That's a super helpful. Thank you.

Participant #4: Is it?

researcher: It is. Yeah, it absolutely is.

Participant #4: I mean, lean construction is, is a big ambiguous thing that,

Participant #4: that just doesn't have a lot of meaning.

researcher: What if I said lean principles?

Participant #4: Lean principles is more, when you say lean principles, I get closer to what your description of lean construction is. Yeah.

researcher: Yeah, I think

Participant #4: the principles I get right. Lean construction is, is that, you know, again, because of the ambiguity, I'll say instead of being so negative, like some people are going to think it's target value delivery,

researcher: [00:20:00] right?

Participant #4: They're going to think

researcher: less,

Participant #4: right, right.

researcher: Yeah, I agree with you. But if I say lean principles, now we're talking the PDCA, the respect for people, the continuous improvement, those.

researcher: Right. So how would you, how would you retitle this thing? I mean,

Participant #4: I, I don't know. I don't, I'm just a while just cause just spit balling. So I'm sure you can massage this, but it's in my head. The real question, the valuable question is what are the, what are the thinking changes that enable application of lean principles,

Participant #4: right? What are the mind shifts Or the mental models that are best suited for application of Lean Principles. Woah,

researcher: woah, [00:21:00] woah, What are the mental models that are best suited to enable Lean Principles on a construction project?

Participant #4: There you go.

researcher: Well, I mean, I, yeah. Okay. I was just looking at that damn leverage point.

researcher: Thing from Daniella Meadows. Have you not seen that?

Participant #4: I don't think so. Oh man.

researcher: Uh, what

Participant #4: is

researcher: it? You got to look it up. The Daniella Meadows are here. Hold on. I'll just show

Participant #4: you're so excited about it.

researcher: It's frigging,

Participant #4: uh,

researcher: leverage it's leverage points on how to change a system. Yeah. It sits on, uh, it's the system on one side.

researcher: Share my screen here and present.[00:22:00]

researcher: Which one is this

researcher: guy? Have you seen this?

Participant #4: Ah, no, but I like it.

researcher: So you have a system sitting on this side of the fulcrum. And then these are ways to change a system. And the further out you get, obviously the more leverage, but mental models is the one that's, and so this is where most of us live, right? With physical events and tools and things that we can actually do within the system.

researcher: But it takes a lot more energy and effort to get that system changed. And if you just apply something out here. Like a paradigm switch, a mindset switch or understand the goal of the system or the structure of the [00:23:00] system or the rules like all the way down, you know, again, physical events, patterns or behaviors, system structure, and then conscious mental models.

researcher: So, um,

researcher: and here I am, like down in here, maybe I'm looking at patterns with the principles. And now you're talking about paradigm shifts. Like what are the paradigm shifts? I think that's even,

Participant #4: yeah. I mean, so I'll give you, I'll share a little more like JPI. They're having like, in, from my perspective, they're going down their path in like lightning speed. The I just had a damn workshop with their project managers last Thursday and the word like they're using the lingo already. And I haven't even been in any 1 of their classes.

Participant #4: [00:24:00] Like, they've only been in 1 session with me and I'm like, where'd you learn that? Oh, well, so and so uses it all the time. And I'm like, oh, oh, okay.

And I don't like. It's only been a year, right? And so it's made its way through the organization on the construction site, and there's, there was a few guys in the thing.

Participant #4: They're like, Hey, Jess, when am I going to get in your class? I've heard about the Lego thing. I need to get in. I said, well, you're in my place. No, no, no, no, the Lego one. And so now it's this thing that people want to be a part of. So we'll just use that as one little micro example. When I was at TD, it took me four years to get people excited to go to my class.

Participant #4: The first three years are like, Oh, I got this damn training. I need to go to the biggest difference that I like at TD that kind of helped spark it and then JPI, the consistency is a TV. When Wes Baker came over, he made it very clear, this is what we're going to do. This is how he was [00:25:00] in a green belt training thing.

Participant #4: And he reported to the team when he was working on what his progress was. He understood the application of the principles. And he said, as the leader. Training's not optional. You're going to figure out how to get these guys into the class period. And guess what guys came to class and we were able to have something meaningful.

Participant #4: JPI, what did they do? They started with their VPs, their directors, their general superintendents, and then they went through the rest of the organization. And they're primarily focused right now is just experiment. Just go try something that you've learned in these Jesse classes and see what you learn and share that knowledge.

Participant #4: So the difference is that, right? They're not who your pool plan doesn't look, you don't have the right state. It's none of that bullshit. Like whatever you learned, go start doing it, start figuring it out. And then let's get back together and figure out [00:26:00] what our flavor, what our specific method is going to be.

Participant #4: So what, so what happened? The leaders demonstrated the behaviors they're seeking. They started learning. They started applying, experimenting. They know what continuous improvement feels like. And then we brought the rest, got, went, cascaded through the organization so that they could have the same experience.

Participant #4: And also they are comfortable with experimenting and trying and having disasters. It's a learning organization. The people that aren't focused or committed to learning, they are self selecting out because why are we doing all this crazy wacky shit? Can we just do it the way we've always done it? Like that's, it's the thinking it's their mental models, how we want to get better.

Participant #4: Let's have some structure and some experiments and let's go do this thing. It's not [00:27:00] you must follow the standard and you know, are you doing all the check boxy, like all that crap? Like that's not it.

researcher: So what, so can you list and rank the five most important factors that contribute to the success of Implementing lean principles for the first time. I'll list them

Participant #4: based on what I've learned. The number one thing that a company or a team needs to get started is one crazy son of a bitch. Okay. And what I mean by that is like one person that is on fire about it that can overcome all the stress, all the friction, all the resistance, all the naysayers, all the failures [00:28:00] that they're going to experience.

Participant #4: Because they're figuring it out too. Right. So you need that one crazy person. No one I know now that crazy person needs a coach or a guide, a mentor specifically for this stuff, like this, the thinking, the experimentation and the organism with the perspective of organizational change, not. Optimization because that poor crazy person is going to run out of steam, but if they have a coach or a mentor, they can help them understand it.

Participant #4: You're on the right path or that they're off path. Um, the other thing is that crazy person, if they have high IQ and EQ, not IQ, EQ, right, do they have tremendous social currency or social capital? That's going to be really important. [00:29:00] Um, and fourth, I would say, leaderships, leadership has to demonstrate visible commitment to learning and applying to things.

Participant #4: And that can be, you know, if I think, if I come back and I'm the crazy psycho on a project, all I need is the person with the most responsibility and influence in that trailer to be learning with me. I don't need the CEO. I mean, ideally the CEO, but usually the crazy wacko that comes back on fire is not like CFO, it's some person way closer to the work.

Participant #4: Um, and so if the person with the most responsibility and influence within, you know, relative proximity is also committed to learning and experiencing this thing, that's definitely going to help it. And then lastly, [00:30:00] They're going to need a problem to solve a specific problem that they're going to go and apply all their genius and all their energy to.

researcher: No. Yeah. Yeah. No, I don't disagree with one thing you said.

Participant #4: And so, and I'll also say that you can get by with three of those. Hell, you can get by with two. It just gets harder and more, uh, more likely to like hell with this. I give up

researcher: failure.

Participant #4: Yeah. Yeah. Failure.

researcher: So based on your interactions with various project team members, what are their [00:31:00] views of lean construction after an initial implementation

Participant #4: that it's usually they're, I'll say the naysayers are like, it's extra work. Um, why are we doing this? Because people should like trade should be doing things for themselves, right?

Participant #4: That's means and methods. That's not our thing. Um, and that, that they say you're looking for an excuse, excited, open minded people are like, Oh my goodness, I can see how this is going to make my day better. We just need to practice at it. We just need to get better. Um, and, and the frozen middle will say, well, this would be great if everybody else would listen.

Participant #4: And that's common team after team trade. GC owner doesn't matter. Early adopters are like, I can see the value. We need to learn how to [00:32:00] do this. We need to practice. They recognize. That it's going to take repetition to get more value out of it. The middle, the frozen middle, it's everybody else's fault. If everybody else would do it, it would be fine.

Participant #4: And I would do it too. But since they're not, I'm not. And then the back third, the blockheads are. concrete heads, um, red hats. It's just extra work. It's just the flavor of the month.

researcher: What do you think the industry's perception of lean construction is?

Participant #4: Well, I think it depends on where you're at. So if you're a lean maniac, we think it's amazing and it's going to transform the industry.

Participant #4: Um, if you're in within like the bigger builders, uh, within, in the country, You recognize that it's a valuable thing and just trying to figure out how to apply it and how to get the most value out of [00:33:00] whatever it is. Uh, when you start getting into builders that are like 250, less than 250 million a year, all the way to residential, they have no idea it does not exist.

Participant #4: And so. Back to maybe a general summary. And my answer is lean people that are familiar with lean have, we have diluted ourselves into thinking that everybody's doing it and we need to get better faster. And the fact is there's a very, very, very small number of people in organizations that are actually.

Participant #4: On the path

Participant #4: we've created like our own little echo chamber.

researcher: What else? What, what questions did I miss? What should I be asking that? I'm not, [00:34:00]

Participant #4: I think, I don't know if you should be asking this question, but the way you have it set up is like, why do lean construction, why does lean construction fail or whatever? I'm struggling to under, like. With the general, what the, what I expect the general understanding to be, I'm struggling to understand what a successful lean construction effort would be.

researcher: Well, you answered that question.

Participant #4: What, for trying and learning? Yeah. No, I know my answer, but you're not writing this for me.

researcher: Yeah, I'm not writing it for the success either.

researcher: I am focused on failures. I mean, yeah, yeah. I mean, that's it. Well, [00:35:00] I guess

researcher: help me connect the dots here, please.

Participant #4: So here's where I'm coming from. You're going to publish something, right? You've got a lot of influence in the industry and on LinkedIn and everything. Um, and so people are going, some people are going to hold it as gospel because who said, and they're going to bastard.

Participant #4: Well, it lends itself to being bastardized and diluted into what's already out there.

Participant #4: And so that being possible, how can your work product help people understand that we're not talking about. Freaking tools and we're not talking about scheduling, right? Like we're talking [00:36:00] about something else.

researcher: Oh yeah. The relational side.

Participant #4: Yeah. The piece that we missed, right. Which, which also I'll add, I think is a natural part of the progression because I don't know anybody in the, from the lean construction space that got into the lean. To make things better for people. Everybody that I know started doing it so that they could have good jobs done earlier and all, you know, all the typical stuff, including

researcher: you,

Participant #4: including me.

Participant #4: Hell yeah. The only reason it made it, why I started even paying attention to attack time and understanding my cycles, the time to deliver and the gap between my bonus [00:37:00] and where we were performing. Was so I can make more money. And so all the concepts that I learned and applied were for that purpose only.

Participant #4: And so as a foreman, it worked really well because I had a lot of command and a lot of power and influence over how people did things could make them do it. And I could smoke their ass if they did it and get somebody else. So the continuous improvement was the thing, right? No, no respect for people. I wasn't trying to develop problem solving skills in anybody.

Participant #4: I was just trying to make them do that shit faster so I can get my bonus. So that's where I started it over years. I realized the value and the re you know, the reality of, Oh shit. If I focus on making the work better for the person, I can get that bigger bonus. And guess what? I might have friends and people won't hate me and people's careers would grow when they're, they're earning like far [00:38:00] bigger implications.

Participant #4: Yeah. Implications than me. Just trying to make money.

researcher: Boy, am I glad

Participant #4: I asked you in my head, whatever my responses were like. Way out in left field compared to what you got.

researcher: Well, that's funny because maybe not as much as you think because the only, the other two interviews are Felipe and Jennifer. So yeah, then

Participant #4: maybe

researcher: not. Felipe's were out there. I'll tell you that.

researcher: Yeah. I asked him the first question and he talked for 25 minutes. Nice. Yeah. All right. What, what else, what else am I [00:39:00] missing? Where's, where's my blind spots?

researcher: Tell me more about how not to be in the same pile of crap as the other ones are.

Participant #4: Well, I don't know. Cause I haven't really read them. Um,

Participant #4: I think even like, even when I hear some of Eli's stuff, like I understood. Okay. So maybe here, maybe this will help you. What a lot of folks have done is shared their story and tried to commercialize their story. What, and what I mean by that is try to appeal to the masses. So that they can generate revenue off of that.

Participant #4: And [00:40:00] because of that, it's a fricking highlight reel that doesn't talk about the realities of deploying change. And it doesn't matter if it's lean or not. Any change is a pain in the ass and it takes a lot of work and there's a way to do it that gains that makes it sustainable. And there's a way to do it.

Participant #4: It'll yield you instant return, but it's not sustainable. Um,

researcher: push first pull creating. Well, yeah,

Participant #4: I mean, sometimes you've got to push, but sometimes you can push. Sometimes push is the right thing to do. Um, but what I mean is trying to appeal to the masses and commercializing your message is going to make it like everything else out there.[00:41:00]

Participant #4: And, and academia, part of the reason the shit is all smells the same. It looks the same. Yeah. Is because of academia. That's the structure, right? You have to conform to whatever that is. So make sense

researcher: when I look around there, surprisingly, I don't see a lot of people that look like me.

researcher: I don't think I'll be conforming anytime soon. Good.

researcher: What else you got in that noggin? That's it. That's it. That's all of it. I don't believe you. Thank [00:42:00] you. Yes, sir. Do you want a copy of this?

Participant #4: Nah.

researcher: Can I use the same? Can I use your name?

Participant #4: Yeah. Yeah. Yeah. You might lose credibility, but yeah,

researcher: I'm getting my PhD. I'm already losing credibility.

Participant #4: Nice.

researcher: It's true.

Participant #4: Well, for some people, some people love it.

Participant #4: Right. Some people will like, he's got a PhD.

researcher: I'll see. I,

Participant #4: yeah. Oh, exactly. There you go. Right?

researcher: trying to get involved, but

Participant #4: don't get me wrong, bro, I, I've witnessed a person earn her PhD and I know how much fucking work, like, just sheer hours. I understand and I appreciate that. But I got my driver's license.

Participant #4: Nobody throws me a fucking parade.

researcher: Fair [00:43:00] enough.

APPENDIX F

Institutional Review Board (IRB) Approval:

Division of RESEARCH Research Compliance

To: Shima N Clarke
Re: Clemson IRB Number: IRB2023-1030
Review Level: Exempt
Review Category: 2
Determination Date From: 17-Sep-2024
Determination Date To: 30-Sep-2027
Funding Sponsor: N/A
Project Title: Survey and Interview on Failures of Initial Implementation of Lean Principles on a Construction Project

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The Clemson University IRB office reviewed your initial submission packet (IRB application and any required supplemental documents) and determined that the proposed activities involving human participants meet the criteria for Exempt level review under 45 CFR 46.104(d). The Exempt determination is granted for the certification period indicated above. A description of the Exempt categories is available on the IRB webpage.

Principal Investigator (PI) Responsibilities: The PI assumes the responsibilities for the protection of human subjects as outlined in the Principal Investigator's Responsibilities guidance.

Non-Clemson Affiliated Collaborators: The Exempt determination only covers Clemson affiliated personnel on the study. External collaborators have to consult with their respective institution's IRB office to determine what is required for their role on the project. Clemson IRB office does not enter into an IRB Authorization Agreement (reliance agreement) for Exempt level reviews.

Modifications: An Amendment is required for substantial changes to the study. Substantial changes are modifications that may affect the Exempt determination (i.e., changing from Exempt to Expedited or Full Board review level, changing exempt category) or that may change the focus of the study, such as a change in hypothesis or study design. **All changes must be reviewed by the IRB office prior to implementation.** Instructions on how to submit an Amendment is available on the IRB webpage

PI or Essential Study Personnel Changes: For Exempt determinations, submit an amendment ONLY if the PI changes or if there is a change to an essential study team member. An essential team member would be an individual required to be on the study team for their expertise or certification (i.e., health expert, mental health counselor). Students or other non-essential study personnel changes DO NOT have to be reported to the IRB office.

Reportable Incidents: Notify the IRB office within three (3) business days if there are any unanticipated problems involving risk to subjects, complications, adverse events, complaints from research participants and/or incidents of non-compliance with the IRB approved protocol. Incidents may be reported through the IRB online submission system using the Reportable Incidents eform or by contacting the IRB office. Review the IRB policies webpage for more information.

Closing IRB Record: Submit a Progress Report to close the IRB record. An IRB record may be closed when all research activities are completed. Research activities include, but are not limited to: enrolling new participants; interaction with participants (online or in-person); collecting prospective data, including de-identified data through a survey; obtaining, accessing, and/or generating identifiable private information about a living person.

New IRB Application: A new Exempt application is required if the research activities continue for more than 3 years after the initial determination. **Exempt determinations may not be renewed or extended and are valid for 3 years only.**

Non-Clemson Affiliated Sites: A site letter is required for off-campus non-public sites. Refer to the guidance on research site/permission letters for more information. Submit the Amendment eform to add additional sites to the study.

International Research: Clemson's determination is based on U.S. human subjects protections regulations and Clemson University human subjects protection policies. Researchers should become familiar with all pertinent information about local human subjects protection regulations and requirements when conducting research internationally. We encourage you to discuss any possible human subjects research requirements that are specific to your research site with your local contacts, to comply with those requirements, and to inform Clemson's IRB office of those requirements. Review the FAQs for more information about international research.

Contact Information: Please contact the IRB office at IRB@clemson.edu or visit our webpage if you have questions.

Clemson University's IRB is committed to facilitating ethical research and protecting the rights of human subjects. All research involving human participants must maintain an ethically appropriate standard, which serves to protect the rights and welfare of the participants.

Institutional Review Board
Office of Research Compliance
Clemson University

IRB Number: IRB00000481
FWA Number: FWA00004497

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