

**Exploring Risks and Mitigating Strategies in Lean
Manufacturing Projects with Special Reference to
UTS Sales & Repairs Ltd.
(Dissertation)**



**University of Wales Trinity Saint David London
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Student Name: George Iulian Chiras (2120095)

Module Code: LCBB6000_LON

Lecturer (Supervision): Dr. Alfred Menzah

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Chapter 1: Introduction

The global manufacturing sector operates within an environment of unprecedented competition, characterised by volatile client demands and relentless pressure to enhance quality while simultaneously reducing operational costs. In this challenging landscape, lean manufacturing has emerged as a fundamental strategic philosophy for organisations seeking to eliminate waste, optimise processes, and maximise customer value. Principles derived from the Toyota Production System, including Just-In-Time (JIT) production, continuous improvement (Kaizen), and value stream mapping, have demonstrated significant improvements in operational efficiency, productivity, and profitability across various industries (Akmal et al., 2022). The compelling proposition of achieving more with less has established lean thinking as a critical framework for companies pursuing sustainable competitive advantage in increasingly crowded markets.

However, the implementation journey often reveals a significant misconception: lean represents more than merely deploying a set of technical tools. In reality, it constitutes a profound organisational transformation that extends beyond procedural adjustments to demand fundamental shifts in corporate culture and operational mindset (Punch, 2016). This transition presents substantial challenges even in standardised production environments, but becomes markedly more complex within specialised, project-based manufacturing contexts. Companies like UTS Sales & Repairs Ltd., operating within the scaffold manufacturing sector, exemplify this complexity through their unique operational characteristics, including customised product specifications, stringent safety regulations, and fluctuating project cycles that define their operational ecosystem.

Within this specific industrial context, implementing lean principles reveals a distinct and heightened risk profile. The reliance on JIT inventory management, while effective for reducing holding costs, dramatically increases vulnerability to supply chain disruptions. Any delay in procuring essential materials, such as specific steel grades, can potentially halt production entirely, jeopardising critical project timelines and damaging client relationships. Furthermore, the inherent emphasis on flow and efficiency within lean systems can sometimes create tension with the uncompromising quality standards required in scaffold manufacturing, where product integrity directly impacts workplace safety. Compounding these technical challenges is the pervasive issue of cultural resistance, where skilled workers accustomed to traditional methods may view lean initiatives with suspicion, fearing job displacement, increased monitoring, or devaluation of their expertise. Research indicates that failure to proactively address these interconnected risks can lead to severe consequences, including project failure, substantial financial losses, and deterioration in both employee morale and product quality (Green and Stoneman, 2016).

Despite comprehensive documentation of lean manufacturing benefits in academic and practitioner literature, a significant knowledge gap persists regarding its specific application, associated risks, and effective mitigation strategies within niche industrial sectors. The scaffold manufacturing industry represents a particularly under-researched domain, with existing scholarship predominantly concentrating on high-volume, repetitive production environments like automotive assembly. This oversight creates a substantial void in understanding how lean principles translate to low-volume, high-variation, project-based manufacturing contexts, highlighting the urgent need for contextualised empirical investigation that addresses the practical realities confronting specialised SMEs.

This research therefore aims to critically investigate the specific risks associated with implementing lean manufacturing principles within UTS Sales & Repairs Ltd.'s scaffold production processes and develop a robust framework of tailored mitigation strategies. The study's significance is dual-faceted: practically, it will provide the case study organisation with evidence-based evaluation of current initiatives and actionable recommendations for enhancement, thereby strengthening operational resilience and competitive positioning. Academically, it contributes to lean management discourse by bridging theoretical principles with practical application in an under-researched sector, offering transferable insights into adapting universal methodologies to specialised manufacturing environments.

Guided by a qualitative case study methodology, this research addresses three pivotal questions: identifying primary implementation risks and organisational obstacles; evaluating current risk perceptions and mitigation efficacy; and proposing evidence-based strategic improvements for cultivating sustainable lean culture, Williams, (2018). This approach facilitates deep investigation of subjective experiences and organisational dynamics, ensuring rich, contextualised understanding that purely quantitative methods might overlook. Ultimately, this research delivers both scholarly contribution and practical guidance for successful lean transformation within demanding industrial settings, supporting enhanced operational performance and sustainable competitive advantage in specialised manufacturing sectors.

Chapter 2 Literature review

The review accords with the existing body of academic literature and has as its aims both to establish a solid or robust theoretical foundation that provides an underpinning for current research efforts. In this work we will exhaustively analyse three subjects that are central to the discussion of lean manufacturing and so show how it takes forward knowledge from a series of different threads. Now we can nail down what is after all a well identified defect in today's systems of lean manufacturing: their applicability to special project types in the realm of machining, particularly within scaffolding manufacture Song et al. While its merits are well known, lean manufacturing is generally regarded as a "strategic philosophy" and has been

discussed extensively in academic circles. As Lopez de Mendoza (2022) put it, scholars like Akmal et al. refuse to accept such an understanding. To say lean is just a toolbox, they say, is far too limited: instead, it should be seen as more like a comprehensive management system developed in line with its chief purpose as the systematic and structured removal of waste--thereby building up customer value virtually from scratch. This particular perspective is vital, in so far as it defines lean's application to a manufacturing setting as something that must rank high on corporate agendas rather than just any old operational fix. Clearly signed as potential rewards are the documented benefits of lean manufacturing e.g.,-Gheorghe et al. (2016) Internal cost reduction at several levels, ranging from lead times being greatly reduced to cutlery-inventory costs being seriously minimized, holds great lure for any manufacturer hoping to excel in productivity and competition. Lean manufacturing yields real benefits. In an environment that demands successful completion of each project for survival, such benefits might in theory enable UTS Sales & Repairs Ltd. to shorten project cycles or enhance its brand name for dependable reliability and security, much as the greater implications discussed by Lowe and Zemliansky (2011) indicate. This established body of work pertaining to the principles and advantages of lean production provides the essential reason—the 'why'—for engaging in lean practice. This lays the groundwork for expending a great deal of effort and resources on its implementation, justified by its successful execution.

Yet the academic debate moves swiftly from an examination of potential benefits to looking squarely at the great challenges that accompany actual practice of lean. A broad consensus among scholars holds that the road to leanness represents a major organizational venture, where high levels of commitment and change are essential. Punch (2016) argues exhaustively that adopting lean principles is a major change in sort of not just a technological one. The culture and inner workings of an organization must shift drastically to match with this new model for it to work. This model is extremely important because it warns both researchers and practitioners from the beginning that with lean thinking one can never stop simply at process maps and efficiency improvements. A company must take into account its own human, organizational culture environment in order to succeed at lean implementation. The risks entailed in this transformational shift are multi-faceted and intricate. As a major obstacle, Akmal et al. (2022) point to. This is very often rooted in fears of job security for workers or lack of complete understanding among services staff about lean principles. It is a concern that applies in particular to a specialized field such as scaffold production. Such an undertaking requires highly skilled workers. Their participation in lean efforts cannot possibly be negotiable. It is absolutely essential.

Additionally, several weaknesses that are specific parts of the entire course of implementing lean practices have been laid out in Martin and Hanington (2012). Consequently, in a failed supply chain catastrophic event could ruin a company's prospects for growth short term future

development and long-term business success. However, for an enterprise like UTS, material restrictions and the need of prompt deliveries mean that this vulnerability is far more than simply a theoretical risk but must be considered as a matter of set operations procedures which could jeopardize project timelines beyond all repairs. Conversely, the literature also stresses that put pressure on efficiency can often lead to conflicts with the quality control process: in cases where there is undue pace other facets of safety critical products such as scaffolding would be compromised by this lack of rigorous standards. Finally, Punch (2016) rightly points out one of the main drawbacks encountered when turning to lean operation is diminished commitment at executive level, where lean is wrongly perceived as a short-term cost saving method rather than an ongoing overhaul for enterprises. To provide better guidance on known risks. This collection therefore sets a structure against which UTS's own experiences and challenges could be systematically measured or appraised.

In response to these well-recognized challenges, scholars have proposed a wide range of mitigating strategies designed to help avoid the potential pitfalls inherent in lean implementation. According to Clough (2012), today, the literature in its various guises is more and more often exploring this theme: Many scholars now advocate for a balanced strategy that takes both technical considerations and human feelings into account such so as to bring about change in ways people can accept as credible rather than forced from without. The mitigation techniques enumerated in the proposal, on the other hand, bear a very strong resemblance to this comprehensive picture. For instance, in order for a workforce's cultural resistance to be overcome, the process of managing change successfully and comprehensive training programs are claimed to serve as crucial methods with which apprehension over job security and role changes can be relieved. To correct weaknesses in the supply chain, the literature recommends that companies change their manner of dealing with supplier from transactional contacts with suppliers to an alliance with key suppliers (the literature suggest this can create a network stronger and more adaptable than any other, which can endure lots of joint disruption). Additionally, including the concept of giving any employee the authority to halt production if an anomaly is detected becomes critical for maintaining quality standards within a lean system. The advice that a transformation be phased and tried out, rather than being regarded as one sudden decisive stroke is also regarded as best practice but allows trial and error learning as well as the whittling down of unnecessary time spent on non - essential activities involved in lean methodologies gradually it has been adopted Julien (2008). Yet, despite this wealth of background theories, hazards and general risk-mitigating solutions, various areas still lack detailed research. And it's on this note that our dissertation sets out to make up for the deficiency in comprehensive knowledge re-balancing principles against risks generally identified in lean thinking or through case studies. while the exact forms of these

same hazards as they might present within a scaffold manufacturing environment have hardly been investigated at all. This study is notable in that it contrasts with his prior works, which were based on high-volume flexible manufacturing contexts rather than work in an inherently non-mass production-industry. Characterized by the nature of being project-based, requirement for custom design and un-complicated safety rules, it is a unique and little understood background worthy of further investigation. Wherefore it will not simply enumerate concealed risks and dangers already widely discussed in the general literature of lean, but when faced with such established objective difficulty it will examine where--though the question seems paradoxical on face value did we shirk reporting on our views. This kind research is essential reading just as with into a real-world empirical analysis and application of generic theories, taking care not to repeat potted histories but planning how one may tailor specifically for its end-users in those wholly unto obscure domains requiring utmost attention.

Chapter 3: Methodology

Introduction

A methodological prose In this chapter, is focus on a detailed discussion of the complex methodology in performing for research, the empirical investigation that is grounded to shrewdly study the different risks and mitigations emanating as result of lean manufacturing practices implementation at UTS Sales & Repairs Ltd. Choice of effective and sound research strategy, together with justifications for doing so, is critical in that it lays the foundations for a systematic and methodical exploration of the research aims and objectives both academically robustly as well as coherently but also practically valid. The most salient features of this study concern the complicated and multi-drafted character of human perceptions, the multi-layered behaviours in organizations, and the situation in which these mind blanks are grounded. Therefore, a process that focuses on eliciting depth (though at the possible cost of breadth and frequency) is considered as pivotal. The subsequent part of the chapter will provide a full exposition to the philosophical principles underpinning, strategic and processes developed and adopted throughout both this study. This will include the logic for the qualitative case design; clinical and theoretical explanation of multi-method approaches to capture rich data across communities and outlined thematic approach that has been carefully considered in preparation for further analyses, Cough (2012).

Research Philosophy and Design

This study is underpinned by interpretivist philosophy and recognises social reality as subjective, constructed by human experience. Such a methodology is appropriate for exploring how UTS managers and employees view lean practice risks, experience changes in the corporate culture or understand what a lean organization would look like. It articulates multiple interpretations informed by organisational roles and personal experiences, all while

drawing attention to the "how" and "why" of issues, which offer intricacies that quantitative methods might overlook. A qualitative study design was selected because of its interest in discovery and interpretation and enabling for an alternative means of trying to understand the multi-tiered nature of the risk in UTS that are loosely captured by quantitative methods. Surveys could detect perceived threats but fail to clarify cultural resistance or managerial difficulties. The nature of qualitative design allows for an in-depth exploration and examination that is needed to answer the research questions and provide practical, evidence-based ideas. This is a qualitative study based on a single case study of the UTS Sales & Repairs Ltd., dealing with lean implementation in its unique project-based milieu. The multiple data sources type of the case study method assists to increase power and generalization through triangulation. Assessing UTS from multiple perspectives allows for an analysis of multidimensional quality and dependencies, emphasising not plain generalisation but in-depth insight.

Data Collection and Analysis Methods

Multiple methods will be used to collect data in order to enhance the study's validity through triangulation and conduct a thorough investigation. The main source of data will be through semi-structured interviews with selected participants (senior management, assistant managers and line supervisors) from three levels within UTS. This multi-layer sampling method guarantees that the data take up multiple perspectives of the organization – strategic perspectives from top-managers, challenges in operational coordination and daily work practices at shop floor level. Using semi-structured interviews, this flexible structure of an open-ended list of questions ensures coverage of the main topics as the interview proceeds, also allows probing on responses that may be particularly significant or to follow up interesting nuance from participants, thus enabling comprehensive investigation of participant viewpoints and experiences. As well as the interviews, two additional sources of data will be used to ensure thorough triangulation. Document review will be used to perform a systematic review of company internal documents to include lean progress reports, quality inspection records, production schedules, and training materials. This approach yields a firm and non-obtrusive source of information that can be used for insights into formal policies, documented performance and the official organizational story point as well as a useful way to countercheck evidence gathered in interviews. At the same time, non-participant observation direct will be carried out scene by: production meetings, special lean events or daily shop-floor work. This allows the researcher to observe lean work as it occurs, relationship dynamics, and cultural routines in action, generating data on feelings and actions that participants may not overtly describe or even be aware of, constituting a direct layer of evidence complementing interview and documentary data.

The qualitative data amassed through these three sources will be subject to thematic analysis based on the systematic six-phase method as provided by Belotto, M. (2018). This approach offers a structured but relatively flexible process of identifying, analysing, and reporting patterns in qualitative data. The first step involves becoming familiar with the data through transcription and deep reading of the material, followed by devising a series of initial codes that systematically mark significant features in the entire data set. The next step is coding and looking for themes by forming these codes into possible ordinate themes and pulling together all the pertinent data under each theme. These themes are subsequently revisited and revised, iteratively tested in relation to the coded extracts and the full dataset. Finally, the next stages consist of identifying and naming themes through rigorous description of them in terms of their nature and parameters and then producing the report itself which combines analytic narrative with illustrative data. This approach will be particularly well suited to this research project as it enables the identification of prevailing underlying assumptions, deep-seated barriers and dynamic strategies in relation to UTS' lean journey.

Ethical Considerations and Research Limitations

Throughout the forthcoming study, the entire process is governed by strict ethical standards. The university has set forth popular protocols that adhere to which research may conduct and interpret data collected. Before any data collection activities begin, the research will require clearance from an independent research ethics committee. In addition, every ethical consideration is treated thoroughly. The cornerstone of this process is the principle of informed consent. Hence a carefully prepared information sheet will be given to each participant-patient, explaining the research goal, the method involved, and their rights as well as requiring them to sign a consent document before approval to participate in any way it is possible to show pictures. All participants must clearly understand that they hold the unconditional authority to withdraw from participation in research whenever they please without fear of consequences or punishment. The confidentiality and anonymity of the participants will be maintained rigorously. The data collection process itself which relies on pseudonyms and storing research subject information in password-protected forms all on secure electronic instruments to ensure company names are never revealed connected with our study. The results of this study will be presented in a manner that is both fair and honest. It is important that reportage show the true story as conveyed by data. Nonetheless, it is necessary also to mention certain restrictions associated with such a methodology. A major limitation lies in the matter of generalizing findings. As this is research with only one case study, the findings cannot be statistically seen in a wider context. The research, however, does have much potential for analytical generalization, whereby the basic theory can be applied to understand similar circumstances in other comparable environments. Additionally, the time during which the factory operates

may make all-round observational analysis difficult, as for instance perhaps an entire lean implementation cycle cannot be seen at one time. Qualitative interpretation itself is intrinsically subjective, but this difficulty is mitigated by methodological triangulation and reflexivity. These are all an attempt to give an approximation of what these pictures would look like if alterations are not made, specifically aiming at ensuring findings that are both valid and reliable while doing justice to the research questions and attaining academic standards all the way through.

Chapter 4: Findings and Data Analysis

Introduction

This chapter goes into great detail on the real-world data that was gathered during the field research at UTS Sales & Repairs Ltd. The main goal is to put together and explain the most essential findings from the qualitative research. This will provide a strong foundation of facts and descriptions for the analysis and conclusions that follow. The data is structured in a way that directly relates to the main research themes of the study. It was mostly obtained through a semi-structured interview with a key managerial informant, supplemented by direct observation and documented analysis. This study investigates the application of Lean manufacturing inside a specific industrial framework, the identification of inherent hazards, and the observable solutions implemented to alleviate such risks, Bloomberg (2008).

To make things clearer and more consistent, the results have been broken down into four key themes. These areas came up on their own because of the way the study was done. Some of the most significant features are a strong dedication to lean principles, operational risks that are relevant to the situation, a focus on safety and quality, and a willingness to react to and lower risks. Direct excerpts from the interview transcript make each issue look better while still retaining the participant's point of view and adding important background on the UTS work experience. The goal of this chapter is to present the material in great detail without changing its meaning in any manner. This sets the stage for the critical synthesis and discussion that will happen in chapter five.

An Ingrained Philosophy of Leanness

The inquiry indicates that UTS Sales & Repairs Ltd. does not perceive or apply lean manufacturing principles as a separate managerial initiative or a contemporary strategic effort. The data, on the other hand, demonstrates that the company's operational culture and history are significantly linked to a mindset that values efficiency and is aware of waste. This guiding philosophy is shown through intuitive, experience-based methods that focus on getting the most value out of materials and saving them, rather than using theoretical models in a formal way. The production supervisor described this long-standing practice by saying, "We've always been lean in how we do things." We don't throw out a lot. This feeling was detailed in more detail with particular operational details, like a stringent limit on scrap and the careful utilisation of all material offcuts, with any excess waste being recycled. The participant said,

"We waste less than 200 mil on anything we do with our material, and that gets melted down," which shows how lean thinking can be put into action in a specific way.

This operating model's strategic drive seems to come from a mix of business sense and personal interest. The company's introduction into the scaffold manufacturing business was driven by the founder's long-held objective and trade knowledge. This suggests that lean methods grew out of a practical understanding of production, Melo (2024). Furthermore, senior management's commitment to this approach is framed as a unified, enduring strategy for achieving competitive distinction via value creation, rather than merely a short-term cost-reduction tactic. The participant said that the commercial reason for this goes beyond just cutting prices. Instead, it focusses on the overall value for money that comes from economies of scale, which are then passed on to the client. This perspective posits that Lean constitutes an essential element of the company's value offering rather than merely an ancillary technology. Because of this, the cultural resistance that people often say is the biggest problem with Lean seems to have gone down a lot at this company. The participant stated, "To be fair, everyone is pretty much on board," seeing that most people were on the same page. In any event, our business model is really simple. This means that the company's Lean goals and operational standards support each other, creating an environment where values are upheld instead of enforced.

Specific Operational Risks

The study discovered a number of operational risks that are directly connected to the company's project-based business model, despite the fact that lean culture is ubiquitous and appears to be an inherent component of the organisation. These issues highlight a serious tension between the complexity of low-volume, custom manufacturing and the efficiency achievable in standardised, high-volume production. The operational duality that the business faces is among the most significant findings of the study. For its mass-produced goods, the corporation spends a lot of money on specialist tools, robots, and jigs, which greatly streamlines and expedites the manufacturing process, Baker (2022). However, there are inherent inefficiencies in custom or bespoke project production. "We don't make a lot of them, so we don't have the tools to do it quickly and well," the participant stated rather clearly. They are therefore more expensive for our clients. This demonstrates a significant risk: the essential Lean tools designed to enhance flow and repeatability might not function as effectively in other organisational areas. This could negatively impact the custom-order portfolio's profitability and responsiveness.

The supply chain's weakness, a theoretical weakness in Lean systems demonstrated by recent events, is a second, very real concern. The company's reliance on just-in-time concepts and lean inventory makes it susceptible to external issues. By discussing how there were

severe material shortages during the COVID-19 pandemic and a total logistical blockade following a geopolitical battle, the participant provided compelling evidence of this shortcoming. "We were purchasing our timber from Russia at the time of the conflict between Russia and Ukraine. Paul said, "So all of the wood we were buying was locked at port." These kinds of incidents demonstrate how supply chain disruptions directly result in production halts, which pose a persistent and grave threat to the efficient operation of businesses. The findings also revealed an internal human resource risk associated with position definition and supervision. According to the participant, "Personally, the risk for me is to get drawn into things that aren't my job... I'm too hands-on at times." This was an open admission of a personal managerial challenge. Although it shows a committed leadership style, this propensity to physically participate in production processes raises concerns about the longevity of monitoring systems and the delineation of managerial responsibilities within the lean operational framework. The real-world data gathered during the field inquiry at UTS Sales & Repairs Ltd. is painstakingly described in this chapter. Organising and elucidating the most significant findings from the qualitative research is the primary goal. This will provide a strong foundation of facts and descriptions for the analysis and conclusions that follow. The information is arranged methodically and directly relates to the study's main research topics. Direct observation, documented analysis, and a semi-structured interview with a major managerial informant were the main methods used to gather it. The application of lean manufacturing in a specific industrial setting, the identification of related hazards, and the observable tactics used to reduce those risks are all examined in this study, Park (2024).

The results have been divided into four major categories for the sake of coherence and clarity. These areas emerged naturally as a result of the analysis approach. Strong adherence to lean principles, situation-specific operational risks, the constant significance of safety and quality, and a proactive approach to risk adaptation and reduction are some of the most crucial characteristics. While maintaining the participant's perspective and providing essential background on the UTS work experience, direct quotes from the interview transcript make each issue appear better. This chapter's goal is to present the data in great detail without introducing any further context. The crucial synthesis and discussion that will occur in chapter five are set up by this.

Quality and Safety as Immutable Priorities

The company's commitment to product quality and safety at work is a major counterbalance and prerequisite for Lean efficiency efforts. When asked if Lean pressures could ever hurt these areas, the answer was clear "Never". The quality and safety of the product are the most important things," the participant remarked. This method is made official by getting certified raw materials and having independent product testing every year to make sure they meet the current safety standards. The data demonstrates that cost-cutting methods are intentionally

kept out of these important areas. They consider quality and safety as non-negotiable requirements rather than things to improve, is interesting taking in consideration Xiang (2025) in "Method for Analysing the Importance of Quality and Safety Influencing Factors in Automotive Body Manufacturing Process. A Comprehensive Weight Evaluation Method to Reduce Subjective Influence", provide insight about how this commitment is put into action by a strong, multi-layered quality management system that is built into the production process. The results demonstrate that there is a rigorous hourly inspection and many verification steps that involve operators, assemblers, and supervisors. The participant remarked, "Nothing leaves here without being 100%," which means that different people check each product at different times. This system provides a clear and active rule for stopping production, which is very important. The participant said that problems are dealt with right away: "We stop making things." We figure out what went wrong. Quality assurance is no longer only a final inspection; it's instead a proactive, real-time activity thanks to staff empowerment to intervene and the multi-stage checking system. In the introduction of a new product, components are carefully pilot tested and thrown out if they don't meet criteria. This keeps errors from getting into the value stream.

Proactive Adaptation and Mitigation

The inquiry shows that UTS Sales & Repairs Ltd. does not see or use lean manufacturing principles as a separate management project or a modern strategic effort. The data, on the other hand, shows that the company's history and culture are closely tied to a way of thinking that values efficiency and is mindful of waste. This guiding attitude is illustrated through intuitive, hands-on methods that emphasise on getting the most out of materials and protecting them, rather than utilising formal theoretical models. The production supervisor said of this long-standing approach, "We've always been lean in how we do things." We don't throw out much. There were additional specific operational specifics about this sentiment, such as a strict limit on scrap and the cautious use of all material offcuts, with any extra waste being recycled. The participant replied, "We waste less than 200 mil on anything we do with our material, and that gets melted down." This is an example of how lean thinking can be put into reality.

The strategic drive behind this operating style seems to derive from a mix of business acumen and personal interest. The founder's long-held goal and knowledge of the craft led the company to start making scaffolding. This indicates that lean methodologies originated from a pragmatic comprehension of manufacturing. Also, senior management's dedication to this method is presented as a long-term, united plan for standing out from the competition by creating value, not just a way to cut costs in the near term. The participant remarked that the business motivation for this is more than merely lowering pricing. Instead, it looks at the entire

value for money that comes from economies of scale, which are subsequently passed on to the client. This viewpoint asserts that Lean is a fundamental component of the company's value proposition rather than a supplementary technology. Because of this, it seems that the cultural resistance that people often say is the worst thing about Lean has gone down a lot at this organisation. The participant said, "To be fair, everyone is pretty much on board," since most individuals agreed. In any case, our business model is really basic. This means that the company's Lean aims and operational standards work together to make a place where values are upheld instead than coerced, Bosman (2022).

Synthesis and Theoretical Implications

A fundamental conclusion arises from the synthesis of these discussions: rather than representing a philosophically motivated shift, lean manufacturing at UTS Sales & Repairs Ltd. manifests as a practical, founder-led adaptation. The company's trajectory diverges from the linear implementation approaches commonly outlined in textbooks. Instead, it introduces a paradigm in which:

1. The founder's operational mindset incorporates the intuitive application of lean principles from the very beginning.
2. Even when theoretical threats are genuine and significant, they are mitigated by context-specific modifications, which are sometimes not entirely explicit.
3. Success is not merely implementing Lean methodologies; it is achieving strategic outcomes such as value, growth, and quality.

This has significant implications for the theory. It indicates that conventional Lean implementation approaches may necessitate substantial contextual adaptation when applied to SMEs, particularly within project-driven industries. The UTS instance exemplifies a contingent or path-dependent approach to Lean, challenging the notion of a single optimal method. The study integrates general theory with practical application by providing a comprehensive, contextualised explanation of Lean within a relatively underexplored area scaffold manufacturing. It illustrates that Lean is more effective when its fundamental principles, the continuous pursuit of value and the elimination of waste are skilfully tailored to the particular opportunities and limitations of the organisational environment. The investigation suggests that UTS Sales & Repairs Ltd. neither recognises nor implements lean manufacturing principles as an independent managerial initiative or as a current strategic endeavour. The data, in contrast, indicates that the company's operational culture and history are strongly associated with a mindset that prioritises efficiency and recognises waste. This guiding philosophy is demonstrated through intuitive, experience-driven approaches that emphasise maximising the utility and conservation of materials, rather than relying on formal

theoretical models. The production superintendent characterised this longstanding practice by stating, "We have consistently maintained a lean approach in our operations." We do not discard a significant amount. This sentiment was elaborated upon with specific operational details, such as strict limits on refuse and the meticulous use of all material offcuts, with any surplus waste being recycled. The participant stated, "We spend less than 200 million on any activity involving our material, and that material is melted down," illustrating how lean thinking can be practically applied in a specific context.

This operating model's strategic direction appears to be influenced by a combination of business acumen and personal considerations. The company's entry into the scaffold manufacturing industry was motivated by the founder's longstanding goal and extensive trade expertise. This indicates that lean methodologies originated from a pragmatic comprehension of manufacturing processes. Furthermore, senior management's dedication to this approach is presented as a cohesive, long-term strategy for attaining competitive advantage through value creation, rather than simply a transient cost-cutting measure, Ionel (2024). The participant stated that the commercial rationale for this extends beyond merely reducing prices. Instead, it emphasises the overall value for money derived from economies of scale, which are subsequently transferred to the client. This perspective asserts that Lean represents a fundamental component of the company's value proposition rather than simply an auxiliary technology. As a result, the cultural resistance frequently cited as the primary obstacle to Lean implementation appears to have significantly diminished within this organisation. The participant remarked, "To be fair, everyone is generally in agreement," noting that the majority of individuals shared the same perspective. In any case, our business model remains straightforward. This indicates that the company's Lean objectives and operational standards are mutually reinforcing, fostering an environment where values are upheld voluntarily rather than through enforcement, Houben (2017).

Chapter 5: Limitations, Recommendations and Conclusion

The limitations of this research, chiefly its classification as a single qualitative case study, prevent its conclusions from being statistically generalisable. The insights are intricately connected to UTS's distinctive history, leadership, and industry standing. Moreover, the perspective is primarily administrative; including insights from frontline personnel could have provided a more comprehensive understanding of Lean culture and its associated challenges. The report provides several practical recommendations for UTS and other small and medium-sized enterprises (SMEs):

1. Formalise the intuitive concept: Document and organise the company's inherent Lean practices. Educating employees on the application of essential Lean tools such as 5S and root cause analysis can facilitate organisational growth by establishing a shared terminology and

a systematic approach to work. This would enhance the sustainability of the culture of continuous improvement.

2. Develop a hybrid operational strategy that clearly delineates the organization's dual-speed performance. Apply comprehensive Lean discipline to high-volume product lines. For bespoke projects, alternatively, adopt a more adaptable, project-management-focused methodology that prioritises clarity and customisation over mere process efficiency.

3. Enhance the robustness of the Strategic Supply Network: Move beyond simple transactional buffers and establish a more comprehensive framework for risk assessment and supplier development. This may involve identifying alternative suppliers capable of supplying essential commodities and collaborating on long-term forecasts to enhance the resilience of both organisations.

Future research may expand upon this work by performing comparative case studies involving various scaffold manufacturers or other project-based SMEs to discern shared patterns and distinctive strategies. Longitudinal research could also monitor the progression of these embedded Lean philosophies over time, especially during leadership transitions or periods of substantial growth, Clark (2012).

This study looked at how UTS Sales & Repairs Ltd., a scaffolding maker, put lean manufacturing ideas into practice in a very detailed way. The study shows that, unlike the usual ways of doing things, lean in this small business is not a separate thing that someone in charge does. Instead, it is a way of thinking about how to run the business that the founder taught everyone to use. The organic adoption has created a culture of efficiency and waste reduction, but it has also introduced new risks to the company, such as issues with the supply chain, differences in the way standardised and customised production are handled, and difficulties in figuring out who is in charge of what.

Important it is to change lean concepts to fit the specific circumstances of each case, especially in project-based manufacturing settings where not a lot of goods are made. It means that when you try to make your operations more efficient, you need to be very careful not to hurt quality and safety. These standards are very important in the lean framework and act as counterweights. This goes against the idea that there is a single path to implementation for everyone. It offers evidence-based methods, such as making unofficial lean practices official and building a strong, strategic supply network, all of which are meant to make operations more flexible and keep the company ahead of the competition.

Future academic work could be helped by looking at similarities and differences in cases in niche production sectors and by looking at how lean theories have developed over time. This study fills a big gap in academic writing by providing a movable strategy for making changes in specific business settings.

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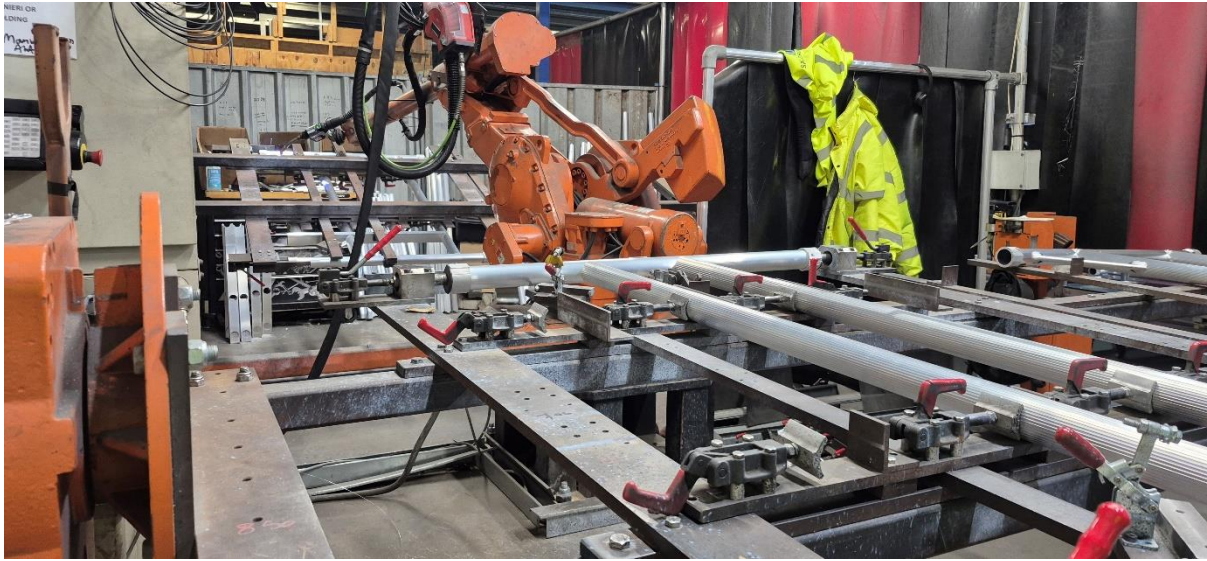
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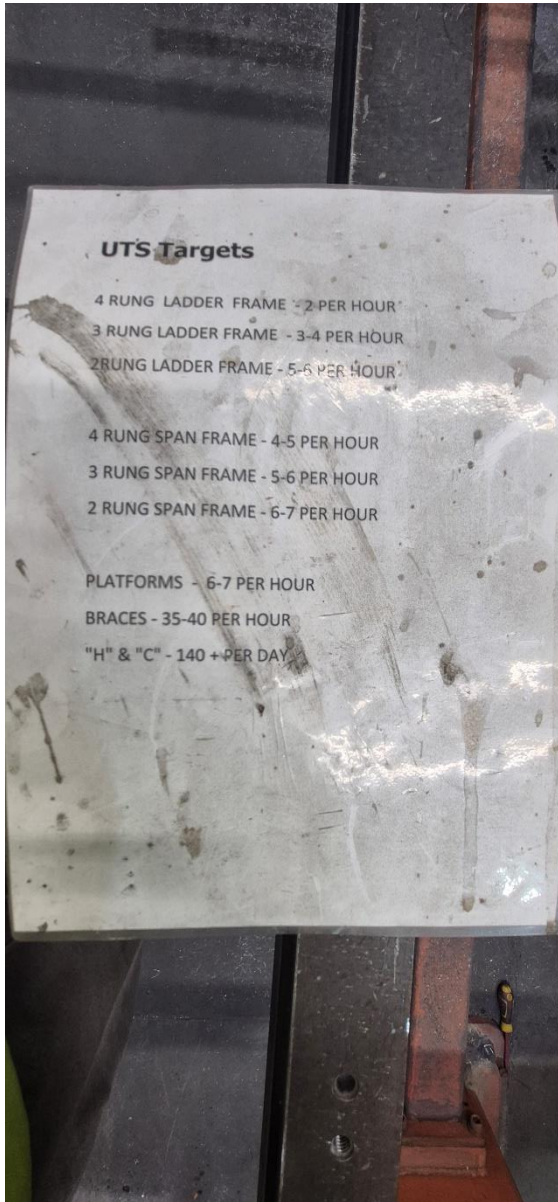
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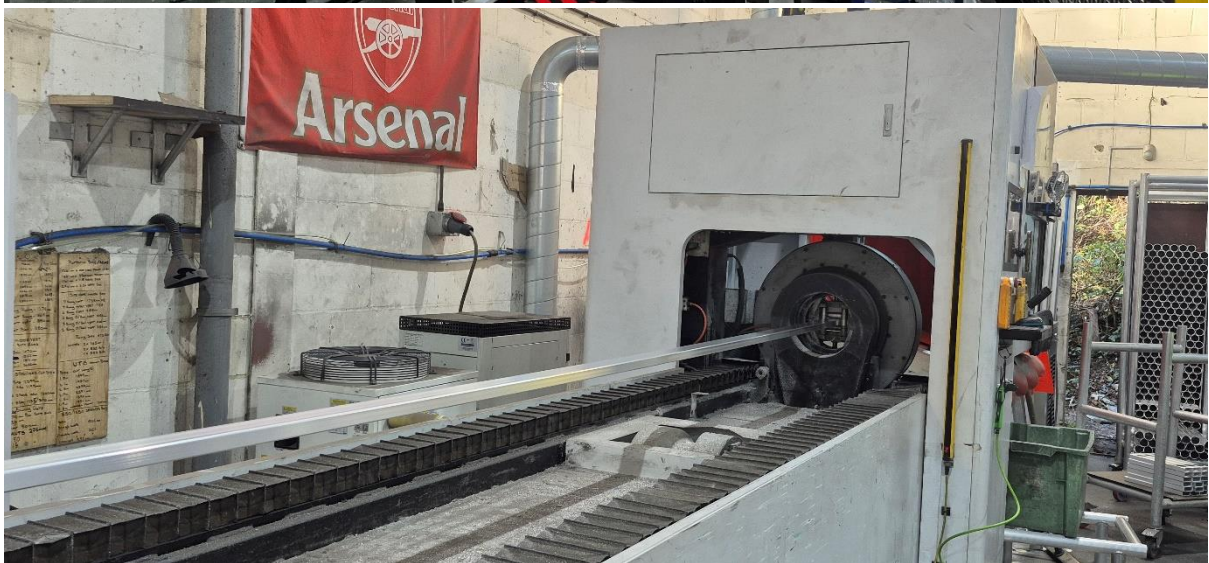
Appendix

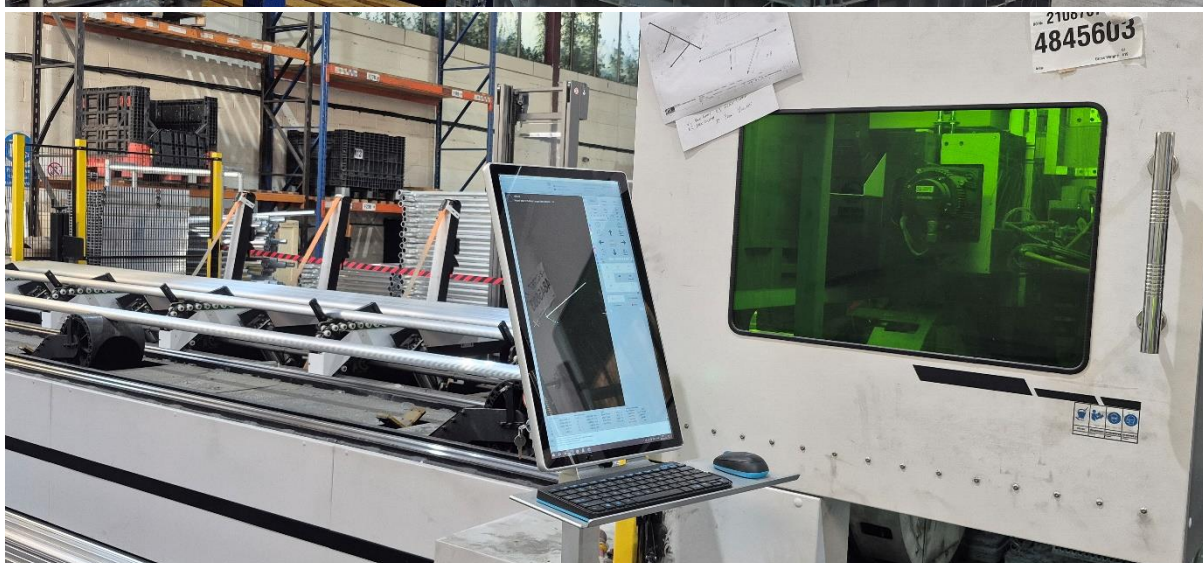














Brace Machine Checklist

Operator Name: DAVID
Date: 2/11/25

	Brace Size:	Centers (+/-mm)		Tube Size (+/-mm)
		1300	1199	
	1.3	1500	1399	
	1.8	1800	1699	
	1.9	1956	1850	
	2.1	2059	1956	
	2.5	2500	2399	
	2.7	2693	2592	
	3.2	3200	3099	
	3.4	3353	3252	

Any issues with Centers stop IMMEDIATELY alert supervisor

Check Centers	Check Tooling
07:30	
08:30	
09:30	
10:30	
11:30	
12:30	
13:30	
14:30	
15:30	
16:30	

Comments: OK

	MON	TUE	WED	THUR	FRI	WEND	WEEKLY TOTAL
ROBOT 1							
800 E Pump							
850 B Pump							
TOTALS	25	25	27	28	28	8	171
ROBOT 2 (DW)							
1400 1M Ladder							
1400 1M Spool							
1400 1.5M Ladder							
1400 2M Ladder							
1400 2M Spool							
1400 3M Pump							
1400 3M Spool							
1400 3M Pump							
1400 3M Spool							
TOTALS	36	35	43	34	33	8	179
ROBOT 3 (PODIUM)							
9.75M							
1.75M							
1.5M							
1.75							
1.5M							
1m 6 Center							
1.25M 4 Center							
TOTALS	29	18	20	20	23	8	151
ROBOT 4 (700)							
700 4 Pump GA							
700 4 Pump							
700 4 Pump							
700 4 Pump							
700 4 Pump							
TOTALS	40	31	30	20	33	8	162
ROBOT 5 (SW/WW/1m)							
700 4 Pump GA							
700 4 Pump							
700 4 Pump							
700 4 Pump							
700 4 Pump							
TOTALS	40	31	30	20	33	8	162

	MIN TARGET	Mon Target	Tue Target	Wed Target	Thurs Target	Fri Target	Wend Target	WEEKLY TOTAL	Expected	%	Notes
BIG RED (1)	500	42.5	0	37.5	0	30.5	0	435	0	100%	
BIG BLUE (2)	500	42.5	0	20.5	0	15.5	0	421	0	84%	
TOTALS								856	0	92%	
SW	5			5		7		17	0	34%	
PLATFORM											
PLATFORM ROBOT	130	16.25	0	9.5	0	12.5	0	48.25	0	47%	
PLATFORM DECKING	130	16.25	0	0	0	0	0	16.25	0	12%	
TOTALS								64.5	0	59%	
ROBOT CELLS											
ROBOT 1 (SW)	35	5	0	30	0	25	0	90	0	25%	
ROBOT 2 (DW)	35	4.5	0	25	0	20	0	70.5	0	20%	
ROBOT 4 (700)	50	6	0	20	0	20	0	66	0	13%	
ROBOT 5 (SW/WW/1m)	32	4	0	12	0	16	0	42	0	13%	
Robot 6 (New SW)	40	5	0	15	0	20	0	60	0	15%	
TOTALS								268.5	0	66%	
STAR ASSEMBLY											
STAR ASSEMBLY	100	12.5	0	10	0	12.5	0	35	0	35%	
TOTALS								303.5	0	75%	

	MIN TARGET	Mon Target	Tue Target	Wed Target	Thurs Target	Fri Target	Wend Target	WEEKLY TOTAL	Expected	%	Notes
BIG RED (1)	500	42.5	0	37.5	0	30.5	0	435	0	100%	
BIG BLUE (2)	500	42.5	0	20.5	0	15.5	0	421	0	84%	
TOTALS								856	0	92%	
SW	5			5		7		17	0	34%	
PLATFORM											
PLATFORM ROBOT	130	16.25	0	9.5	0	12.5	0	48.25	0	47%	
PLATFORM DECKING	130	16.25	0	0	0	0	0	16.25	0	12%	
TOTALS								64.5	0	59%	
ROBOT CELLS											
ROBOT 1 (SW)	35	5	0	30	0	25	0	90	0	25%	
ROBOT 2 (DW)	35	4.5	0	25	0	20	0	70.5	0	20%	
ROBOT 4 (700)	50	6	0	20	0	20	0	66	0	13%	
ROBOT 5 (SW/WW/1m)	32	4	0	12	0	16	0	42	0	13%	
Robot 6 (New SW)	40	5	0	15	0	20	0	60	0	15%	
TOTALS								268.5	0	66%	
STAR ASSEMBLY											
STAR ASSEMBLY	100	12.5	0	10	0	12.5	0	35	0	35%	
TOTALS								303.5	0	75%	

ROBOTS											
Totals											
MON	TUES	WEDS	THURS	FRI	W/End	WEEKLY TOTAL					
60	76	20	20	25	0	201					
ROBOT 3 (S/NW+D/W Lm)											
700 4 Rung CR											
700 4 Rung											
700 6 Rung											
700 Walkthrough											
700 T Rung											
850 1M Ladder											
850 1M Spohn											
850 1.5m Ladder											
850 1.5M Spohn											
850 2M Ladder											
850 2M Spohn											
850 4 Rung											
850 6 Rung											
850 8 Rung											
1450 1M Ladder											
1450 1M Spohn											
1450 1.5M Ladder											
1450 1.5M Spohn											
1450 2M Ladder											
1450 2M Spohn											
1450 4 Rung											
1450 6 Rung											
1450 8 Rung											
Totals											
12	16	23	5	40	0	106					
PLATFORM DECKING											
1.5M Trap											
1.5M Trap											
1.5M Hand											
1.5M Trap											
2.5M Trap											
2.5M Fixed											
Totals											
PODIUM ASSEMBLY											
Wk 1 Breakdown											
Wk 2 Breakdown											
Wk 3 Breakdown											
Wk 4 Breakdown											
Wk 5 Breakdown											
Month											

Deck Robot Check Sheet						
Operator Name:	Leon H					
Date	28/11/25					
Check Material length	1201 (+/-1mm)	1401 (+/-1mm)	1701 (+/-1mm)	2401 (+/-3mm)	2401 (+/-3mm)	
Product:	1.3	1.5	1.8	2.5 Trap	2.5 Fixed	
07:30:				✓	✓	✓
08:30:					✓	✓
09:30:					✓	✓
10:30:					✓	✓
11:30:					✓	✓
12:30:					✓	✓
13:30:					✓	✓
14:30:					✓	✓
15:30:					✓	✓
16:30:					✓	✓



Interview Transcript: Lean Implementation at UTS Sales & Repairs Ltd.

Interviewer: George (Speaker 1)

Interviewee: Paul (Speaker 2)

George: Okay, Paul. My name is George, nice to work with you. Our discussion will be regarding Lean manufacturing implementation at UTS and organizational commitment. We all know Lean manufacturing is an approach to avoid waste in the production area. So, based on this topic, this research is conducted for my dissertation thesis at University of Wales Trinity Saint David in London. Are you ready to start?

Paul: Yeah, okay.

George: So, the first question would be: How would you describe your current understanding of lean manufacturing and its core principles at UTS?

Paul: Within here at UTS, my understanding is second to none. I mean, we have very little wastage. We're leaning what we don't know inside and out. On what we do, I know inside and out.

George: Second question is, what motivated UTS to begin implementing lean practices in scaffolding manufacturing?

Paul: It was an industry that our owner, Mike, knew very well, and it was something that he always wanted to get into. He was trained as a welder, and his first job was to do manufacturing of scaffolding equipment. He always had ambitions to make it himself. We started off buying and selling second-hand towers, and then he wanted to get into production himself. And now, actually, we are industry-leading.

George: How committed do you feel the senior management is towards supporting Lean as a long-term strategy, rather than a quick cost-cutting exercise?

Paul: We know we're not just looking at cost. We look at time and such, with value for money. Obviously, we're wholesaling. We mass produce. Getting value for money, yes, we buy things in bulk, but that allows us to buy at a cheaper price because of the bulk, so we can then pass that on to our customers.

George: Has Lean adoption required any significant cultural shift? If so, how has this transition been handled?

Paul: Oh, really, we've always been lean with how we do stuff. We have very little wastage. Every material we have, we can get right down to the smallest offcut. All of our offcuts are used for something else. Our wastage is less than 200 mil on anything that we do out of our material, and that gets melted down. Aluminum is recyclable, so it goes to a scrap yard where it's melted down, so there is very little wastage. And the wastage that we do have, we get the money back for it in scrap value.

George: Okay, let's move to the next chapter about risks and challenges. The question would be: What major risk have you personally observed during Lean implementation in your department?

Paul: Personally, the risk for me is to get drawn into things that aren't my job. So, when we are busy in manufacturing, my job is more to oversee that and to make sure that everyone is doing their job. But I'm too hands-on at times, and I get involved in making sure that the manufacturing processes are done and adhered to throughout, sometimes doing it myself.

George: What specific challenges does your project-based operations, such as bespoke scaffold fabrication, present compared to high-volume manufacturing?

Paul: So the project-based, bespoke-made fabrication... we obviously don't make a high volume of them, so we don't have the tooling in place to make them as quickly and efficiently. So they come at a higher cost to our customers. Obviously, our mass-produced items, after we've spent the time investing in robots and machinery and jig work, that means that we can produce everything as lean as possible. So anything that we do repetitively, we try and streamline the process as much as we can.

George: Have you experienced supply chain disruptions that affect Just-In-Time production?

Paul: Unfortunately, we are at the behest of our suppliers for a lot of stuff, material-wise. Especially during COVID, it was a nightmare trying to get hold of some aluminum. When the whole Russia-Ukraine conflict kicked off, we were, at the time, buying our wood from Russia. So all of the wood we were buying was locked at port and wasn't allowed to be unloaded because of all the sanctions put on the Russian cargo ships. So we had to find other suppliers for our material. On a day-to-day, we have quite a good relationship with our suppliers. We tend to help each other out as much as we can. But unfortunately, there are times where we have to get creative to make stuff happen.

George: Do you feel Lean practices increase pressure to prioritize speed over product quality or safety?

Paul: Never. Safety is paramount, as is the product quality. We don't try and get more out than we can. We set very reasonable targets where we can maximize speed, efficiency, and output at the same time.

George: What kind of resistance to change have you seen among the workforce during Lean transformation efforts?

Paul: To be fair, everyone is pretty much on board. We are, as a business model, quite lean anyway. We have very little wastage, whether that be material or time. Everything we do is designed to be as easy, as quick, as efficient as possible, because it's a wholesaler and it's repetitive. We make lots and lots of the same thing. There are jigs and punches and presses set up to make the manufacturing process as lean as possible.

George: Are there any resource limitations, such as time, budget, or workforce, that hinder Lean progress?

Paul: I mean, you could always have more money to buy more machinery. That's always an option. But within our setup, the way we're working, as soon as we've got the profit there to reinvest in new machinery, we do. We've upgraded lasers, we've upgraded saws, we've upgraded robots, we've upgraded jigs. Anytime we can afford to, we reinvest and get the latest technology to make things as quick and as easy, as efficient as possible.

George: And as we grow, do you engage with the community in creating the workforce?

Paul: As we grow, we need a lot more staff, and we employ from local areas. We've got a work club in Manston, where the people live in Planet Work. We've got one here in Canterbury, where people from all over, obviously, travel to. We've got one in London, where people in London...

George: Okay, regarding quality and safety considerations: How is product quality assured under the condition where inventory buffers are reduced?

Paul: Our product quality is always assured. There is never any reduction in the quality of it. We don't keep chopping and changing, trying to scrimp and save and make material cheaper. Our raw materials are our raw materials. They are all certified. Our products themselves are all sent off for testing annually to make sure they adhere to the latest policies and procedures regarding health and safety and that they conform to standards. Reducing costs anywhere or reducing manpower doesn't affect the quality of our product.

George: Have there been any incidents or close calls where Lean practices increased the risk of compromised safety standards?

Paul: When we're looking at making new products, obviously, we test rigorously before we put anything into production. So when we were looking at making a new brace claw, for argument's sake, we sent it out to a company. They sent it back. We tested it. It didn't fit, so it was rejected straight away and sent back to them to make it to our specifications.

George: What mechanisms exist for employees to stop production if a problem is identified?

Paul: We do hourly checks, where we check products. And again, myself as a supervisor will come around and check on opposite hours. If anything that we notice has gone awry or isn't where it's supposed to be, we stop production straight away. We identify the root cause with these checks. Nothing leaves here without being 100% finished. We've got an operator who checks it, we've got an assembler who checks it, and then there's the final check, and also the person who's loading on the van checking as well. So everything we make is checked multiple times by multiple different people.

George: Regarding human factors: How have the employees been trained for Lean methods, such as continuous improvement or waste identification?

Paul: As a business model, we don't really have waste, whether that's time or materials. So all of our employees are trained in our working practices. From day one, they are taught to be as efficient as possible with their time and with the material that they are using. There is continual improvement that we can do, obviously. And employees are trained in multiple different areas, so they get to see the entirety of the product. They know why they're doing what they're doing, and they can help minimize wastage of time and materials because they're seeing the whole journey of a product.

George: Do you feel employees have the skills and confidence to engage in Lean-based problem solving? Or why not?

Paul: I think so. I think all of our employees are competent. They know what they're doing, and they know why they're doing it. And with that comes the knowledge to be efficient and lean with their time and with the materials they've got. If they have a large piece of material and it gets damaged, rather than throw it away, it goes back to the store and it gets cut down into smaller pieces to keep wastage to a minimum.

George: Okay, we go through the mitigation strategies questions. What specific tools or methods, for example, value stream mapping or 5S, have been successfully adopted so far?

Paul: That's above my pay grade as to what we do with the costing and everything... mitigation strategies towards wastage. Obviously, all of our materials are specific to a certain length that we want, that we know we can calculate out of it. That's all factored into the cost when you buy it. Castings and the like, again, bought in bulk so we can get everything nice and cheap. But with regards to value stream mapping, I can't really help you with that. I know we try to go, try to go Net Zero, low carbon.

George: What risk mitigation strategies have been most effective in reducing risk during the Lean implementation? Any strategies?

Paul: Don't waste. Strategy: don't waste. There you go. That's your strategy.

George: How does UTS work with suppliers to reduce vulnerability within the supply chain?

Paul: So a lot of our suppliers, obviously, we work directly with. They manufacture the components that we have. So there is no chain as such. It is straight from raw material production to us. A lot of it is in the UK. We try to keep it as local as we can, so we're not getting beaten again if anything kicks off and ports get closed or anything like that. And where we are a wholesale company, we buy everything in bulk. It's a constant rolling order from our suppliers. They know exactly what we need every week, every month, and they can constantly produce that. So we're always ordering ahead. We keep a stock of stuff off-site and top that up as and when we take from it.

George: Do you use pilot projects or phased rollouts to test Lean changes before full implementation?

Paul: We do test new products. I mean, we've got our pilot products. The industry we're in, someone's pretty much already done it before us. So it's a case of playing catch-up, where we're the new boys on the block. If there is a product out there that is doing well and it's something that we feel we can make better, then obviously we will make a better version of it.

George: How does UTS currently measure the success or progress of its Lean initiatives?

Paul: The money we make, right? We know exactly what we need to buy, material-wise, based on orders and production. That's why we have targets. It allows us to see exactly what we're making hour after hour, day after day. It allows us to know what we need to buy material-wise. We know there's very little wastage on the material. So at the end of that, we know what we're making profit-wise.

George: What improvements in productivity, lead time, or waste reduction have been documented so far?

Paul: Obviously, you can see the improvements in productivity by the evolving robots, two laser cutters. One of them is only four, five years old, and that's already been upgraded to another laser. The robots, again, they've gone from being one-headed robots to two-headed robots. We've gone from having two of them to seven, eight. So we're constantly looking at ways that we can produce more and keep that same quality.

George: What do you think are the biggest current weaknesses in UTS's Lean approach?

Paul: I mean, the way we're set up, we're pretty efficient. I wouldn't say there's any massive weaknesses in what we do. The only thing maybe, maybe the knowledge of new employees. Employees are constantly getting trained. There's constant training and progression throughout for everyone. People are always learning. We're always learning. There's always new technology coming in that we can evolve and manifest, get into our manufacturing process somewhere. Weaknesses is the cost of new technology and constantly evolving and competition. Maybe, if competitors start investing the way we have in technology, maybe then that puts our customers at a crossroad, whether they've got to choose to go here. Our competitors might want to lower their prices to try and steal customers. There's always going to be someone trying to steal our business. We haven't got a monopoly on the market.

George: What additional support or training would help UTS strengthen its Lean implementation?

Paul: We're very good at showing people multiple jobs and seeing the journey of the product that they are making, so they understand what they're making, why they're making it, and why being lean with their time and the material is important. Obviously, we can always do more and show people more of the products and the complete cycle of the product. But given that we repair the products as well, we are as lean as you can be when it comes to wastage and the same with all the machinery.

George: What future improvement strategy would you recommend to achieve a more resilient and sustainable Lean culture at UTS?

Paul: As the technology grows, especially with our laser cutters, the chuck that holds the material has to have an offcut. There are machines out there that can use that offcut as well. So as technology evolves and machinery gets better, there will be the scope to be able to have even less wastage than we currently do. You can always buy a smelter and smelt the material down and send it back. We can sell our scrap back to the aluminium wholesalers that we buy it from. There are other avenues that we can do to make ourselves slightly leaner, but at the moment, that's not on our radar. We're still looking at growing the business rather than trying to make it leaner.

George: So those are the questions. I think that's very much it. Thank you. And if you've got anything else, maybe some pictures or documents of the robots, that would be great for the study.



PG2_Application_for_Ethical_Approval_1