

Lean Implementation: An Investigation in Successfully Adopting a Lean Philosophy

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Abstract—The implementation of lean thinking in the manufacturing industry revolutionized the traditional approach to large-scale production through the process of identifying the waste in each task and putting in place mitigation measures to eliminate the waste in all its forms. The Irish construction industry, however, has been much slower to adopt the principles of lean, opting instead to stick with the traditional approach to construction project delivery which is inherently wasteful. Lean thinking holds the potential to revolutionize the construction industry in a similar manner to the adoption of lean manufacturing. Lean principles present opportunities for reduced project duration, reduced project cost, improved quality, and elimination of re-works and non-value-added activities. This research has been designed to accumulate research data through available literature, electronic surveys, and interviews. The results show an industry reluctant to accept change and an undefined path to successful lean construction implementation.

Keywords—Barriers, lean construction, lean implementation, lean manufacturing, lean philosophy.

I. INTRODUCTION

THE culture in the Irish construction industry has traditionally been opposed to change, preferring instead to maintain the status quo, utilizing tried and tested methods of design and construction. Although these methods may deliver the project, the processes used will often lead to lost time, overspend on budgets and unnecessary waste in many forms.

The manufacturing industry, however, has taken a different strategic approach, preferring to utilise lean techniques and tools to re-design the production processes, to identify and remove waste in all its' forms. This reimagining of the production process has resulted in record high production numbers, reduced lost time events & increased efficiencies.

With the advent of Lean Construction (LC), a new collaborative approach to construction project design and delivery has seen positive change in project delivery & cultures in the construction industry worldwide.

This paper looks at international & national examples of the implementation of lean philosophies in both the manufacturing & construction industries. It attempts to identify the most suitable implementation techniques and tools for the Irish construction industry, whilst also trying to identify the barriers that many organisations meet when implementing a lean culture.

The research includes analysis of existing lean implementation/lean maturity assessment tools; these tools are

frequently used by organisations before, during, and after their lean journey. However, while these tools can be useful for many organisations, they can be generic and may not be suitable for construction companies. This difficulty maybe due to the inherent nature of the industry not delivering the same project more than once, for lean to work best project repetition is ideal, e.g., manufacturing a product thousands of times can make identifying waste in the process much easier when compared to a construction project that is to be built once.

It is hypothesised that there is a generational change within the construction industry, i.e., new entrants into the industry are introduced to lean thinking without being made aware of the fact or being trained in the concept. The procedures that are introduced to new entrants/apprentices are part of a lean culture but is not being presented as such, it is merely 'the way things are done.' This approach is juxtaposed to the teaching of lean philosophy which requires the buy-in and education of all those individuals involved at all levels. The author will attempt to analyse this approach through existing academic research data focusing on implementation techniques utilised in both the manufacturing and construction industries.

Primary data will be collected & analysed by way of: (i) pilot survey with apprentice construction trade personnel; (ii) survey of mid management construction & manufacturing staff; and finally (iii) interviews with lean informed mid management level staff with experience implementing lean. It is hoped that, as a result of the research complete, a more suitable LC implementation roadmap can be created that could be utilised by a wider variety of construction companies regardless of scale/discipline, including training approaches for new and existing staff within the organisation to best secure buy-in.

A. Objectives

The aim of this research was to investigate the status of LC industry in the Irish market, and to determine how a change from the traditional approach to construction to a modern lean approach to construction would be welcomed in the Irish market. The research also aimed to determine the barriers that could affect successful implementation of LC as well as identifying the drivers for a move towards a fully formed LC industry.

We also wished to investigate how best to replicate or redesign the approach utilised to implement a Lean Manufacturing (LM) philosophy. Using the knowledge gained as part of this research a roadmap to successful LC implementation will be created that can be used by construction companies implementing lean thinking into their business strategy regardless of company size.

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II. METHODOLOGY

The research methodology was designed to gather knowledge through existing literature regarding the development of the lean philosophy concept in the manufacturing industry, and the adoption of lean thinking in the construction industry in the 1990s.

This secondary research would allow for the research to determine the principles of lean thinking and how these principles could be applied to both the manufacturing & construction industries. The benefits to both industries would be determined and the driving forces behind the adoption of lean would also be investigated.

The primary research design was developed as a mixed method as it was agreed that both quantitative and qualitative data were needed firstly to understand the current status of LC in the Irish market, and secondly to gather real world experiences of those in the industry who have either successfully or unsuccessfully implemented a lean philosophy in a construction company. The research design also included the review of a number of relevant case studies based on past lean implementation experiences.

The primary research consisted of the following elements:

- i. Pilot Survey
- ii. Main Survey
- iii. Interviews

Due to the COVID-19 pandemic, all primary research was complete using electronic means, survey was distributed electronically via the use of Microsoft Forms, and the interviews were complete using Microsoft Teams meeting function. The Pilot Survey (i) sample set consisted of 57 electrical apprentices; this sample set represented a wider population of new entrants to the construction industry in Ireland. The main survey (ii) sample set consisted of 72 professionals at various levels in both the manufacturing and construction industries within Ireland. This sample set represented a larger population operating in both industries. The Interview (iii) panel was made up of six mid management professionals operating in either the manufacturing or construction industries in Ireland.

III. LITERATURE REVIEW

It is widely acknowledged that LM, sometimes referred to as Lean Thinking, originated from the Toyota Manufacturing Company in the 1970s. During this period the company created the Toyota Production System (TPS), that was used to eliminate non-value-added activities in the production process. The core concept of the TPS acknowledged that all processes contain some degree of waste, the key to improving or adding value to the process is to identify the waste & put in place measures to reduce the waste to its minimum possible size or ideally eliminate the waste altogether [17], [2].

However, as discussed by Pettersen [16], there is no clear consensus as to the definition of lean manufacturing, and this fact can often lead to confusion at a conceptual level & also at a practical level when companies are trying to implement lean in their operations. Pettersen [16] also determined that there is

no one framework or template that can be utilised for all organisations, instead more success may be achieved if each organisation adapts the principles of lean to suit their own needs, essentially developing a bespoke lean approach that is tailored to their specific needs.

The success of lean philosophy in the manufacturing industry presents a promising opportunity for construction professionals to adapt & implement this approach in the construction industry, as organisations in the market strive to remain competitive and profitable [5].

Since its inception in the 1970s, the philosophy of lean has been gaining traction throughout the world of manufacturing and is now commonplace in one form or another in most manufacturing settings. The levels of LM awareness amongst the workforce varies with the size of the business. Lean awareness is more likely in larger organisations than in SMEs [21]. The level of lean awareness varies depending on the position within the company from a top-down perspective, members of senior to mid management tend to have higher level of lean awareness and understanding, than those at a lower level in the organisation's structure.

There appears to be a lack of lean awareness throughout the construction industry [1], [7], which is surprising considering the obvious benefits that implementing a lean philosophy can bring to a business. This lack of awareness of lean in the construction industry is worrying, with a survey of US based construction industry personnel, finding 48% of respondents had no awareness of LC [3]. It is important to remember when comparing lean awareness in both industries that LM has been in existence far longer than the concept of LC, which was only in its infancy in the early 1990s [12]. LC was developed in 1992 by the four godfathers of LC – Glenn Ballard, Greg Howell, Mike Casten and Lauri Koskela, alongside a team of likeminded academics [12].

Similar to LM awareness being more prevalent in larger scale organisations [21], the same is true of the LC philosophy, which appears to favour larger organisations, likely due to having a higher number of available human resources and financial capabilities to invest in new construction methods [10].

Carmody et al. [8] noted that the traditional construction methodologies have begun to struggle due to growing social and economically responsibilities, and client demands. A global push towards more sustainable methods of project design and delivery has seen an introduction of Modern Methods of Construction (MMC); these include modular construction, use of prefabricated elements, use of lean tools, digitisation of project design [10], [14].

However, the Irish construction industry has been slow to introduce MMC, preferring instead to utilise tradition construction techniques, despite their often-inadequate results [8]. It is theorised that the reluctance to adopt a new approach to project delivery is due to the nature of implementing any new concept or philosophy into a business requiring additional resources in the form of financial, labour and time.

Similar to the implementation of LM, it has been stated that no one implementation approach can work for every

organisation to successfully introduce LC to their business [6]. This is more evident in the construction industry due to the lack of repeatability of projects and the variety of disciplines operating in the construction sector, for example electrical, mechanical, civil engineers etc. All these factors present additional difficulties and barriers for successful lean adoption.

The traditional construction approach brings with it inherent inefficiencies, a study of the UK construction industry identified up to 30% of tasks having to be re-worked, work efficiency ranging from 40-60% and over 10% of materials are wasted. If these inefficiencies could be recovered it would represent a significant cost savings to the UK construction industry & achieve better value-added services to the end customer [19], as well as being applied globally.

The growing trend towards LC has not only been fuelled by internal organisational strategic objectives, but also from client demand & Government directives. It is widely acknowledged that all industries must be aware of their environmental & social responsibilities, ensuring that their operations are sustainable & eliminate waste/reduce the amount of wasted materials [9].

Ahmed et al. [1] identified numerous challenges to the implementation of LC, specifically in Bangladesh, citing 41 barriers & only identifying seven benefits to the Bangladeshi construction industry. The most concerning element put forward in this article is the lack of awareness found in the country regarding LC principles and the potential benefits that can be gained from successfully introducing lean tools.

Aslam et al. [3] found that many of the lean organisations that were analysed often had difficulties in initially identifying the best lean tool or technique for their situation due to lack of in-depth knowledge of the lean concept, which in turn presented barriers for lean implementation.

However, there have been success stories when implementing lean in construction companies, while these cases have met barriers, the addition of companywide lean education played a key role in the company's success, as well as the company strategic objective identifying the necessity to change their approach & implement change [15].

It is a common theme with the successful implementation of LC that the process is lead from the top of the company down to the lower levels, when a senior manager champions the vision, the process is much more likely to be successful than without the direction from senior management.

IV. DATA ANALYSIS

The primary data collected by the authors, consisting of two electronic surveys and six interviews, were analysed to identify the following traits amongst the construction industry in Ireland:

- lean awareness levels
- the level of lean utilisation
- the level of lean promotion
- the perceived objectives and priorities of the employers
- status of lean education & understanding
- availability of lean training

- barriers to successful lean implementation
- favoured lean tools & techniques.

The pilot survey was designed to investigate these traits amongst new entrants to the Irish construction industry that could signal a generational change in the approach to training new entrants to include a lean philosophy or approach to completing work tasks. The survey found that only 21% of survey participants were able to acknowledge any awareness of lean as a concept, the majority of participants (73.7%) believed that they had no understanding or awareness of the concept of lean, despite later in the survey 82.4% of participants being able to confirm the use of at least one lean tool.

We believe that this indicates that there is a trend of employees training new entrants on how to complete certain work tasks using a lean approach but failing to educate the staff in how the approach uses a lean philosophy, to the staff it is just the way the task is done.

Table I summarises the five most commonly used LC tools/techniques as per the Pilot Survey.

TABLE I
TOP 5 LEAN TOOL RANKINGS

Ranking	Lean Tool	% Response
1	Toolbox Talks	75.4%
2	Prefabricated Containment	54.4%
3	Standardised Work	24.6%
4	Building Information Modelling (BIM)	19.3%
5	Offsite Constructed Modular Containment	17.5%

The Main Survey was designed to investigate the same traits within both the manufacturing and construction industries, with a more experience demographic. The sample set included mid-management level personnel with varying experience of lean philosophy implementation. The level of lean awareness amongst this group was 93.2% of participants acknowledging some level of lean awareness. We theorised that the variance of lean awareness levels between the two surveys was the result of the following factors:

1. The experience level of the main survey participants to that of the pilot survey sample set. The main survey sample set is far more experienced and holds positions of more responsibility and seniority compared to the pilot survey sample set.
2. The size of the organisations in which the sample sets are employed. When analysing the makeup of the main survey participants, it was found that 70.3% of those surveyed were employed by companies within excess of 100 staff, whereas when analysing the makeup of the pilot survey participants, only 31.6% of those surveyed were employed by companies of a similar size.

62.2% of main survey participants confirmed that their company utilises at least one lean tool as part of their daily activities (27% of those polled were unsure). When comparing the use of lean tools by industry, it was found that 86.2% of those employed in the manufacturing industry used lean tools (15.8% were not sure), whereas only 61.9% of those employed in the construction industry regularly used lean tools (23.8%

not sure; 14.3% do not use lean tools.

The participants were asked to select from a list of lean tools/techniques, the most widely used lean tools by industry are as follows¹:

- Manufacturing
 1. Preventative/Pre-planned maintenance – 79.3%
 2. Root analysis – 68.9%
 3. Standardised work or Process mapping – 41.4%
- Construction
 1. Building Information Modelling (BIM) – 71.4%
 2. Prefabricated containment of offsite constructed modular components – 52.4%
 3. Root cause analysis – 38.1%

The overarching objective of this research is to ascertain the methods of lean philosophy implementation and lean education utilised in each industry, and to determine if education is essential for successful lean implementation. This education can take the form of informal or formal training sessions, workshops and/or webinars. Data were collected from the participants in an attempt to determine the accuracy of this statement, by way of interrogating the presence of training and level of lean promotion within the organisations.

Survey results show that there was a split of 39.2%/55.4% (Yes/No), regarding the presence of lean training within the organisations polled. This information was further interrogated to determine the split between manufacturing, which it could be assumed would be more likely to have some form of training due to the historical presence of LM, and construction, which was believed to be less likely to have formal lean training processes due to the relevant infancy of LC within the Irish construction industry. The findings of this further analysis show that lean training is more likely present in a manufacturing setting as 48.3% of manufacturing-based respondents confirmed they had received some form of LM training, where 61.9% of construction-based respondents confirmed they had not received any form of LC training, the results are illustrated in Table II.

TABLE II
 LEAN TRAINING MATRIX

Response	Overall	Manufacturing	Construction
Yes	39.2%	48.3%	38.1%
No	55.4%	37.9%	61.9%
Maybe	5.4%	13.8%	0%

The survey participants were asked to confirm the presence of lean promotion within their organisations. The results show that promotion of lean is present in 40.5% of respondent organisations, however, it should be noted that 23% of respondents were not sure, allowing for the possibility that the true figure of lean promotion being much higher than recorded.

The survey confirmed that only 17.6% of respondents confirmed that no barriers were encountered when implementing a lean philosophy.

The figures below indicate the ranking of barriers

¹ Figures indicate the percentage of those polled utilising each lean tool.

experienced by participants in each industry²:

- Manufacturing
 1. Resistance to change of lack of engagement – 55.2%
 2. Lack of training/education or awareness – 51.7%
 3. Lack of resources time, money, or people – 34.5%
- Construction
 1. Lack of training/education or awareness – 47.6%
 2. Lack of resources time, money, people – 42.8%
 3. Resistance to change or lack of engagement – 38.1%

The data gathered from the main survey illustrates that lack of education and training is a barrier to success in both industries, ranking 1st for construction (47.6%), and 2nd for manufacturing (51.7%).

The survey participants were asked to detail the benefits they encountered when utilising lean principles/tools, the findings are detailed below according to industry³:

- Manufacturing
 1. Reduced downtime – 72.4%
 2. Increased overall equipment efficiency – 65.6%
 3. Increased production volume – 62.1%
- Construction
 1. Reduced project cost – 52.4%
 2. Reduced project duration – 47.6%
 3. Increased overall equipment efficiency – 23.8%

The one-to-one interviews provided an opportunity to delve deeper into the experiences of the interviewees, allowing the interviewees ample scope to give examples of what they perceived as being valuable qualitative data as part of this research activity.

The interviews were categorised by the industry that the interviewee was working in, i.e., manufacturing or construction. The key learning points from the interviews can be seen below:

- Manufacturing
 - Only 1 out of 3 interviewees had received any form of official lean training or education,
 - Visual Management was utilised as one of the first lean tools introduced,
 - Lean implementation started as a small project to prove the concept before large implementation commenced,
 - Lack of education & training was a barrier to successful implementation,
 - Ingrained cultural barriers were common in long term work force,
 - Engagement & communication was acknowledged to be a key factor in successful implementation,
 - Support & buy-in from senior management was acknowledged as critical for success,
 - The importance of including the supply chain in the lean philosophy movement was stressed by multiple interviewees, as well as the accuracy of information being shared within the supply chain– ‘garbage in, garbage out’,
 - Engagement and trust amongst the team can be a

² Figures indicate the percentage of those polled who experienced each barrier.

³ Figures indicate the percentage of those polled who experienced each benefit.

challenge but is necessary to ensure success – ‘winning hearts & minds and building trust’.

- Construction
- None of the interviewees had received any form of official lean training or education,
- Pre-construction phase was identified as being critical for implementing lean & eliminating waste during the design phase before clashes happen on site,
- Lean implementation requires the buy-in from all levels, including those on the ground performing the tasks,
- Those performing the tasks feed information back up to management as they know what is required to complete the task, can identify waste easier, team effort required,
- LC is being driven by larger companies,
- Lean implementation is a resource heavy project that favours larger companies, causing SMEs to avoid LC implementation,
- Process mapping was identified as being key to success, allows waste to be identified & work to be standardised across all future projects,
- LC must be included in all aspects of the business operations, i.e., design, procurement, Health and Safety (H&S), operations,
- Communication is vital especially on site, the use of Visual Management Display boards is now commonplace on sites,
- Scrum meetings and weekly look ahead are used extensively to control project schedules and work tasks,
- BIM has been widely accepted as the future of construction design, usually accompanied with visual display hubs installed on site for use by supervisors or workers on site to answer queries or investigate potential clashes before they happen avoid lost time,
- Buy-in from all those involved was acknowledged as being critical to successful adoption of LC,
- A move towards modular installations has been very successful with larger companies, allowing for offsite construction of project components in turn reducing the time needed on site, reducing the cost of the project and project duration,
- Time constraints were identified as a barrier to LC implementation, the task of process mapping each work activity is both time and resource heavy but vital to identify and eliminate waste,
- Training and education were confirmed as being a key factor in the successful implementation of LC.

V. DISCUSSION

A number of themes have been identified during the research process; these themes are discussed below:

Theme 1: Lack of Lean Training

As discussed in the Literature Review, there appears to be a lack of lean awareness/training in both the manufacturing and construction industries [4], [7], [20]. This is not very surprising in the Irish construction industry as it is commonly known that the construction industry is very slow to

implement change. If we consider that Lean Construction Ireland (LCi), the group tasked with promoting the benefits of LC to the Irish marketplace, was only formed in 2014, the lack of LC amongst SME construction companies proves that perception that the construction industry is very slow to implement change and is driven by larger enterprises. The main survey confirmed that 55.4% of respondents had not received any lean training. Further analysis found that 61.9% of respondents working in the construction industry had not received any lean training, providing further proof of the theme first discovered in the literature review.

The survey also confirmed that only 48.3% of respondents based in the manufacturing industry had received any form of lean training. This is an alarming figure, as previously discussed for the lean philosophy to work it requires the buy-in from staff and also the support/leadership of senior management [2]. This support can take many forms including providing training and education to the staff, especially those who will be in direct contact with the lean tools/thinking in their day-to-day activities. Considering that LM was first conceptualised in the 1970s, then spread across the globe in the manufacturing industry, becoming the standard by which, most manufacturing plants operate, it is then surprising that there is a lack of company promotion of lean training and that it is so prevalent market wide, the main survey confirmed that only 40.5% of respondents confirmed any form of lean promotion was present in their workplace.

The success of LM since its initial introduction would prove the benefits of lean thinking to any business, including reduced re-works, increased efficiencies etc. [17], however, this proof appears to have failed to secure the training needed to invest in future lean projects.

Theme 2: Lack of Lean Awareness

Similar to theme 1, there also appears to be a lack of lean awareness, especially in the construction industry [1], [7]. A survey of US based construction companies found that 48% of respondents had an awareness of the concept of LC [3], if we consider that the Lean Construction Institute (LCI), the US based group tasked with developing the LC community, was formed in 1993, the concept has failed to fully permeate the construction industry since its formation thirty years ago.

Focusing on the Irish construction industry, the pilot survey found that of the respondents (tradesmen based in the construction industry for less than five years), only 21% of them had any awareness of lean. The respondents in this pilot survey are members of the construction industry with less than five years' experience, which may highlight a potential issue with how lean is being introduced to new entrants, the new entrants maybe trained in a lean approach, but they may not be educated as to how the approach is lean and the philosophy behind lean, it may 'just be the way things are done'.

Another potential cause of the low figure for lean awareness amongst this sample set is that 77.2% of respondents work with companies with a workforce smaller than 200. As previously discussed there appears to be a correlation between the size of the organisation and the likelihood of any lean

awareness/training present within the organisation [21].

Theme 3: Driving Force for LC

The traditional construction approach is inherently inefficient with many activities providing opportunities for waste or non-valued added elements to be present during a project [19], the philosophy of lean is to remove waste in all its' forms [17], and hence add value to the customer/project. This value can come in the form of increased efficiencies, projects complete ahead of schedule, less conflict on site and reduced costs, as identified by the main survey participants [13]. In order to remain competitive, some construction companies have chosen to implement lean within their organisation, this has been a driving force for the lean movement in recent years.

Similar to the introduction and promotion to Health & Safety of the 1990's & 2000's in the Irish construction industry, the implementation of LC appears to be driven by the larger construction contractors [10], [11].

The global movement towards implementing MMC, including the utilisation of lean thinking and lean tools, has been necessary due to a number of factors such as social, environmental, financial, and sustainable pressures and responsibilities [8], [10]. For example, the introduction of 3D BIM software, has had a huge influence on the industry's modernisation [10]. BIM has been widely adopted within the construction industry in Ireland, with 71.4% of main survey respondents working in the construction industry confirming that they use some form of BIM software.

Theme 4: Barriers to Successful Implementation

A common theme that materialised during the course of primary data analysis is the cultural barrier to implementing any new process or philosophy. There appears to be an ingrained culture in companies, especially companies that have had long term employees for a number of years and decades. The staff appear to be slow to accept change, often being hesitant to believe that the motivations of management are simply to improve the production output and make everyone's life easier. There may be several reasons behind this apprehension of staff, the most likely is a human resources issue, any company with a long serving work force will, undoubtedly at some stage had a situation where conflict was present, depending on the resolution to this situation, there may be resentment present on behalf of the staff and this can materialise in the form of opposition to change, this was highlighted by multiple interviewees based within the manufacturing industry. 55.2% of main survey participants from the manufacturing industry identified resistance to change or lack of engagement as the main barrier to lean implementation.

In total, the main survey identified thirteen barriers to successful lean implementation, with the most common barriers being:

- Resistance to change
- Lack of training/awareness
- Lack of resources

These barriers are similar to those identified in the Literature Review and represent a consistent factor in recorded failures of lean implementation, with one study finding a failure rate being as high as 60% [18].

The barriers identified support the hypothesis that education and team integration are key to the successful implementation of a lean philosophy, if the staff are properly supported and trained then success is far more likely, and with it comes the benefits for the business.

Some of the barriers discovered during the course of the research process, appear to be present because of lack of adequate foundations being present when adopting a lean philosophy, for example, lack of training was one of the most common barriers confirmed. There are several other barriers that are linked to lack of training, including lack of awareness, lack of buy-in and lack of understanding, if during the initial stages of lean implementation, the project team secured the support of senior management, this could support could secure investment in education and training of all staff, eliminating the initial barrier of lack of training, and removing the snowball effect of additional barriers. Once the foundation is strong, it is much easier to build upon it.

As discussed, many of the barriers to lean implementation seem to be linked at a basic level, for example lack of training can cause lack of buy-in, many of these barriers seems to stem back to a basic lack of understanding of what lean truly is and how it could be applied successfully to each individual process.

VI. LEAN IMPLEMENTATION

The lack of a LC template that suits all organisations regardless of scale or discipline should not deter any business from undertaking a journey toward lean adoption. The principles of LC should be kept in mind at all times when designing the implementation plan, barriers will be met, and it will be a long journey, but success is possible and achievable, true lean is not a one-time experience, it is a continuing journey that should never end, we should always strive for perfection and continuously improve. Through the process of researching LC implementation, the following practical roadmap for successful implementation of LC has been designed that may be prove useful for LC implementation regardless of industry or scale of organisation, see Fig. 1.

To avoid potential barriers to successful LC implementation, it is important to ensure that the correct structure and team communication processes be implemented during the initial project commencement. Failure to put in place adequate forethought or lines of communication will increase the possibility of project failure.

The foundation elements of the roadmap are to secure senior management buy-in and support, identify and elect lean leaders at different levels of management. Investment in lean training of staff should be included at this point, this process may be time consuming but if the knowledge base is not there, then implementation can be flawed. The business supports should be investigated and utilised. LCi offers support and guidance to those undertaking a lean journey, there is also a

growing community of members that can offer practical advice and evidence of how they implemented LC in their business.

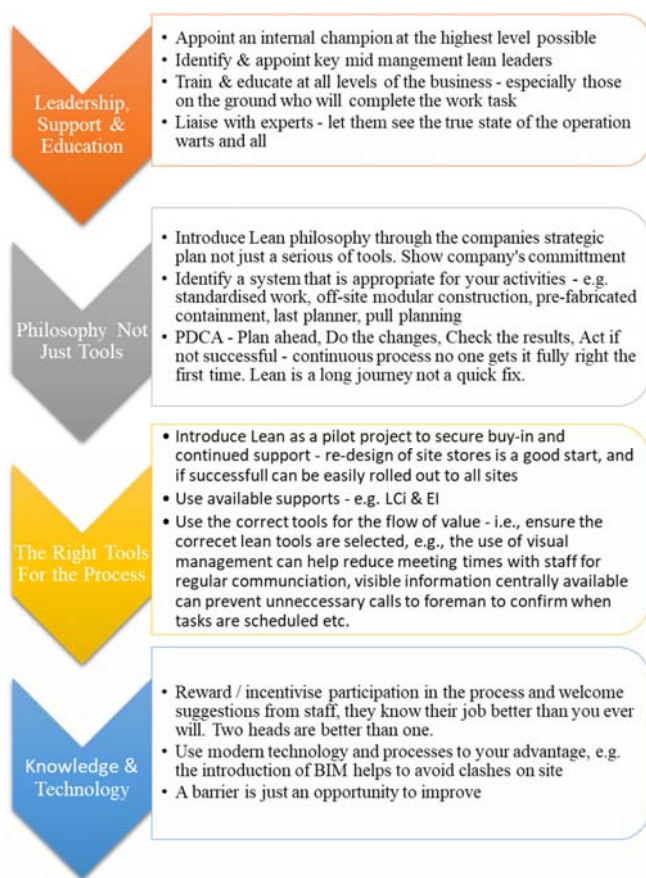


Fig. 1 Roadmap to Successful Lean Implementation

It is important to remember that lean is not just a set of tools, to get the true value of lean it must be adopted as a philosophy. It is best to implement lean into the company's strategic plan, further demonstrating the company's commitment and support for the journey. The difficulty most companies have when implementing lean is identifying what approach will best suit them, this is where the supports available will really help, speaking with experts and other companies with practical experiences of implementing LC can provide the key to identifying the correct approach and tools to use. The lean journey is not just a once off project, it is a journey of continuous improvement, the company should strive to perfect their activities. No one gets it all right the first time.

A pilot lean project is recommended to secure the buy-in of all levels of staff, securing their support at an early stage will make the process of full lean philosophy implementation a lot easier and smoother. Ideally the pilot project should be something that can be reproduced easily on other sites, for example a re-design of the site stores layout to optimise stock level monitoring and ease of access. Communication is key for success, streamlining communication can reduce wasted time

and eliminate confusion, the use of visual information management boards can be very useful for information sharing.

Introducing a reward scheme to incentivise the buy-in and engagement of staff can help overcome any cultural barriers to successful implementation. Integrating the staff into the project team and welcoming suggestions from all levels of staff can achieve unity and boost morale. The use of modern technology and MMC is important, as actively working as part of a continuous supply chain can achieve greater synergy amongst the project team, i.e., main contractor, sub-contractor, suppliers, clients etc. The development of long-term relationships can achieve more efficient processes as individuals will get to know the other members of the supply chain and how they can work together to deliver better value, this understanding comes with time.

Remember a barrier is just an opportunity to improve – lean is a journey of continuous improvement; barriers can be overcome with enough thought and resources.

VII. CONCLUSION

While there has been success when adopting LC internationally, there has been a reluctance to fully implement lean in the Irish construction sector. It is a commonly held belief that the Irish construction industry is a very slow-moving beast, and not very open to change. Meaning the adoption of any new method of design or construction can be met with apprehension and resistance.

The same can be said of the adoption of LC on a large scale in the Irish construction sector. Unlike LM which has been welcomed, LC has struggled to get a foot hold in the Irish sector. There has been a movement from larger construction companies, especially M&E contractors, to implement some form of lean thinking or philosophy to ensure competitiveness in the market. SMEs, however, have not yet introduced lean as a philosophy, the lack of lean awareness and lack of available resources have been suggested as the main barriers to lean implementation by SMEs.

The lack of an agreed upon approach to LC implementation increases the perceived difficulty to introduce lean thinking in the construction industry. The uncertainty surrounding lean philosophy and lack of lean knowledge creates obstacles for its widespread adoption in the Irish construction industry.

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