The Benefits and Challenges of Adopting Lean Principles in Project Management

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ABSTRACT
This comprehensive research paper examines the application of Lean principles in project management, exploring both the benefits and challenges associated with this approach. Through an extensive literature review and analysis of empirical data, the study investigates how Lean methodologies can enhance project performance, reduce waste, and improve customer satisfaction. The research also identifies key obstacles in implementing Lean project management, including cultural resistance and the need for specialized training. The findings suggest that while Lean principles offer significant advantages in project management, successful adoption requires careful consideration of organizational context and potential barriers. The study provides a conceptual framework for integrating Lean principles into project management practices and offers evidence-based recommendations for organizations considering the adoption of Lean project management.

Keywords: Lean project management, waste reduction, continuous improvement, value stream mapping, organizational culture, project efficiency, pull planning, Last Planner System, visual management, kaizen

1. INTRODUCTION

1.1 Background of Lean Principles

Lean principles, originally developed in the manufacturing sector, have gained significant traction across various industries due to their focus on efficiency and waste reduction. Originating from the Toyota Production System in the mid-20th century, Lean philosophy emphasizes creating more value for customers while minimizing resource consumption. The five principles to be followed in Lean are identifying the real need, value stream mapping, creating flow, establishing and using the pull system, and finally the process of fine tuning or making something perfect. These principles have been successfully implemented in the many different fields such as healthcare, construction industry, software development etc. and therefore they prove that they can effectively help in enhancing the organizational performance.

1.2 Problem Statement

A lot has been achieved by the implementation of Lean principles in industries, manufacturing and across departments but when it comes to Lean and its usage in project management, it comes with its own advantages and challenges. Indeed, projects are by definition temporary and often possess specific objectives and limitations that are not the same as Lean processes that are conceived for continued operations. Peculiar to project work is its flexibility and instability and, as such, project environments need adaptations to typical Lean frameworks. Also, the growing number of stakeholders participating in project implementations and. Moreover, the level of organizational implementation of Lean thinking remains on different levels of maturity. Therefore, the purpose of this research is to discover which of Lean strategies can be applied to project management environments and the main advantages and limitations of their application.

1.3 Research Objectives

The main research questions of this study are to determine whether Lean Project Management offers any advantages in project management, whether there are any issues to consider when applying Lean project management, to construct a theoretical model of Lean implementation in project management context, and offer practical recommendations based on the emergent findings for organisations planning to adopt Lean project management. To this end, these objectives are as follows They are justified based on three reasons: Lack of comprehensive research on the use of Lean principles in project-based organisations; and the provision of guidance to improve the application of Lean principles, both for practitioners and academicians in project-based organisations.

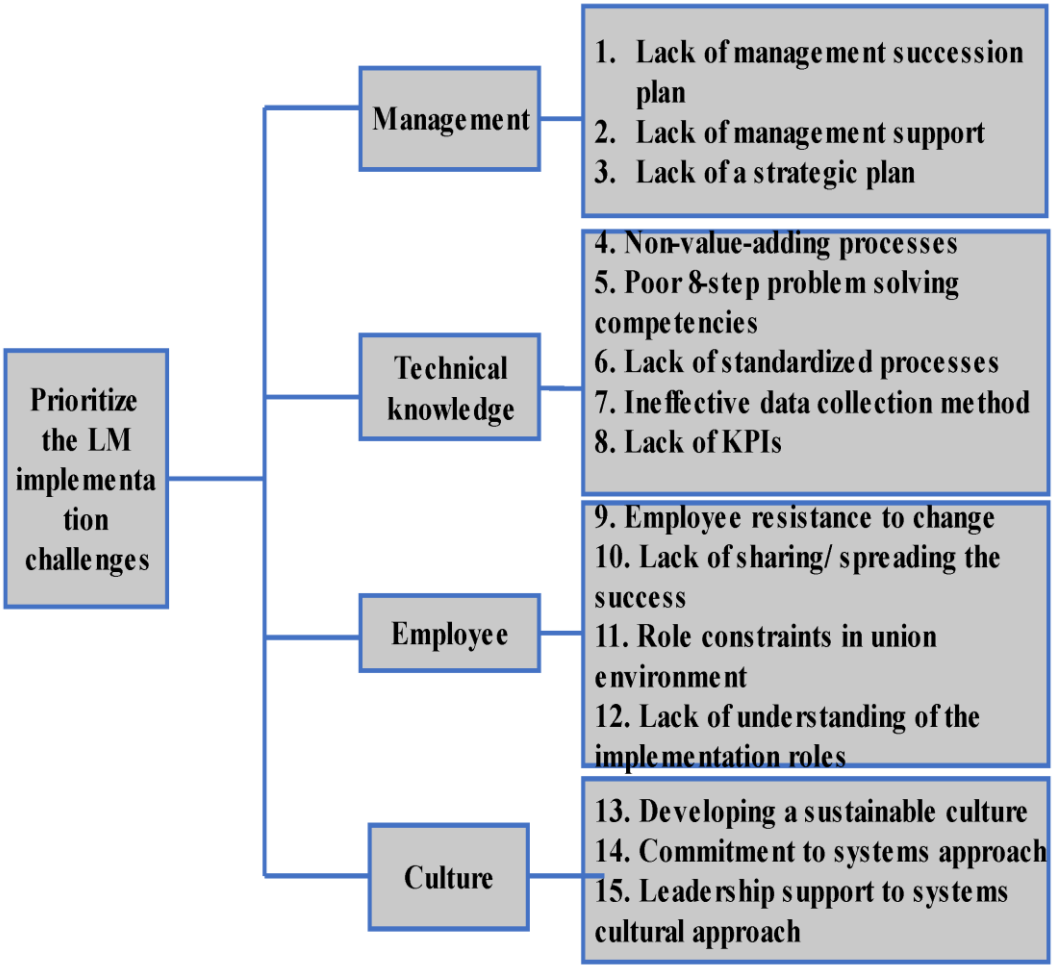
1.4 Significance of the Study

Since organizations look for ways to enhance the performance and productivity of their projects, analysing the effect of using Lean thinking in project management becomes vital. This research adds to the knowledge base by presenting an exhaustive evaluation of the advantages and the obstacles related to Lean project management and pointing out findings that will benefit the exercise of this discipline's practitioners and stimulate further research in this subject. The conclusions drawn from the study may go a long way in changing the practice of handling projects in different organizations and domains, giving better results, less wastage, and higher customer satisfaction. Moreover, the conceptual framework that was introduced in this research may provide the basis for empirical research as well as for application of Lean project management in practice.

2. LITERATURE REVIEW

2.1 Lean Philosophy: Origins and Evolution

Lean, in fact, is an enterprise management philosophy derived from the Toyota System initiated by Taiichi Ohno in the mid-1950s. Originally confined in the manufacturing industries, Lean concept has now swelled over the fields in manufacturing, health, construction, software and many more. Depending on Womack and Jones; the 5 core Lean principles are recognizing value, value stream mapping, creating flow, using pull as a system and striving for perfection through the improvement process. These management principles seek to avoid waste, increase effectiveness, and make customer value.



Lean as a concept has evolved over the time and we have gotten different tools and methods such as Value Stream Mapping, 5S, Kanban, and Just in Time. These have been advanced and modified overtime depending with the context of the industries. For example, by employing Lean in healthcare systems, patient satisfaction and time of waiting has been enhanced and Lean used in software development made the development process faster and satisfying.

2.2 Project Management: Traditional vs. Lean Approaches

Classic methodologies of project management, described in the PMBOK, for example, are based on detailed planning, the control of many aspects of the project, the strict adherence to the schedules and costs initially set. They may also be based on a top-down, planned approach to project delivery, with much focus on paperwork and the official change management procedures. On the other hand, Lean project management focuses on flexibility, deployment of various improvements and enhancement of the processes of elimination of waste at every stage in the project life cycle.

Table 1. Comparison of Traditional and Lean Project Management Approaches

Aspect	Traditional PM	Lean PM
Focus	Plan adherence	Value creation
Planning	Detailed upfront planning	Rolling wave planning
Change management	Formal change control	Embrace change as an opportunity
Resource allocation	Push-based	Pull-based
Quality management	Inspection at end	Built-in quality
Customer involvement	Limited, mainly at start and end	Continuous throughout project
Continuous improvement	Post-project lessons learned	Ongoing throughout project
Risk management	Risk mitigation plans	Fail fast, learn quickly
Team structure	Hierarchical	Cross-functional, self-organizing
Performance metrics	Time, cost, scope	Value delivered, cycle time

2.3 Key Lean Principles in Project Management

Some of the Lean concepts have been applied in project management environment as will be seen below. Value Stream Mapping is a tool that is used in the identification of unnecessary steps that are involved in the execution of work within projects in order to eliminate them; it provides a picture of the flow of work. There is Pull Planning where scheduling activities follow the downstream demands rather than pushing activities according to the schedule's plan; this assists in the right flow with less work-in-progress.

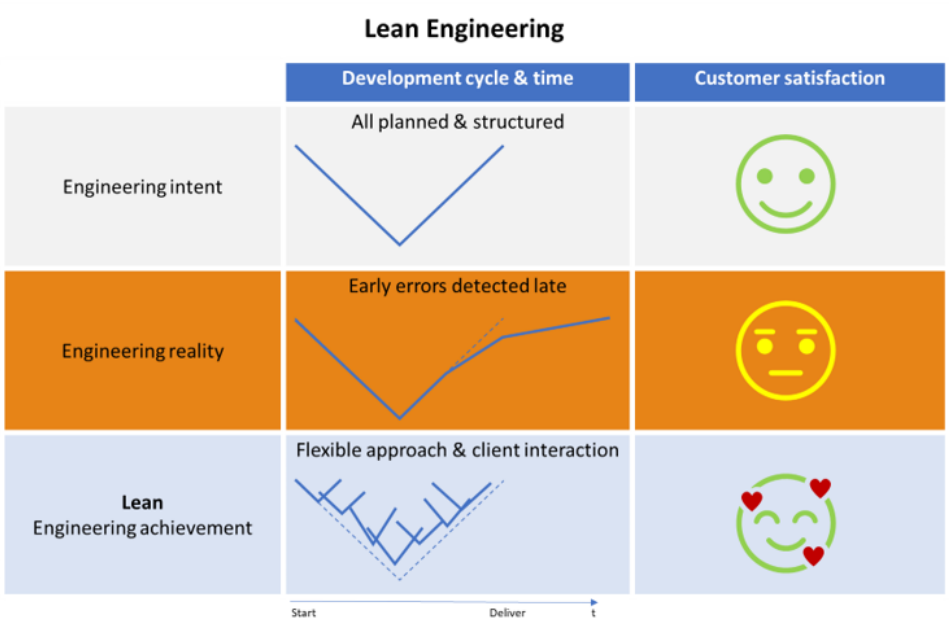
These flow relations are the Last Planner System or LPS which is a collaborative, commitment-based planning system that enhances the dependability of work flows, by including front-line contributors in the planning process. Visual Management systems improve the quantity and quality of status/progress reports that allow for rapid decisions and identification of issues. Kaizen is a process of making small improvements continuously throughout the project Cycle so as to make it a culture or continuous improvement.

2.4 Previous Studies on Lean Project Management

Many papers have looked into the performance of Lean principles in more project management settings and in a broad range of industries. Ballard & Howell have applied Lean techniques in the construction sector and documented an increase in the delivery time of projects and cutting down of costs. Their research also revealed that Lean construction projects revealed gains of an average of 30% when compared with conventional construction project undertaking durations.

Appendices and Appendices extended Lean to software development to present Lean Software Development approach that focuses on waste reduction, and value addition in IT undertakings. Research scholars have estimated that Lean software development projects can deliver about 40% improved time-to-market and 50% low incidence of defects as against normal waterfall models.

Oppenheim et al. explored the effectiveness of Lean in aerospace engineering where adopting Lean on the complicated engineering ventures enabled the company to enhance the cycle time and cost. Their study found that they were able to achieve on average a time saving of 25% on development time of new aircraft components where Lean project management best practices were adopted.



3. Theoretical Framework

3.1 Lean Theories

There are some theories from which the theories of Lean project management are derived as follows; Theory of Constraints by Eliyahu Goldratt is the recognition that a specific area or point of a system will be the constraint, where capability is limited. Since this theory also deals with flow and continuing improvement, it can be regarded as being in harmony with Lean philosophy. Importance of Lean thinking is expressed in the Toyota way of management that is developed by Jeffrey Liker and is consisted of 14 principles; the long-term philosophy, the right process produces right results, adding value to the organization by developing people, and relentless pursuit of organizational learning by solving root causes of problems.

3.2 Project Management Models

The most popular formats of project managing previously are Waterfall model and V-Model which are used in many industries. These models are characterized by predefined steps and such an approach also stresses documentation. New methods, such as Scrum and Kanban, have been developed as a response to traditional approach; those stress iterative processes and change. These models include the work of Rosenau and also Walter, the latter being complemented by lean project management strategies involving waste minimization, continuous flow and customer focus.

3.3 Conceptual Model: Lean-Project Management Integration

Drawing from the exposed literature and theories a conceptual model that would help in the integration of Lean principles to project management is developed. This model emphasizes the following key components:

1. Under the emerged strategic bearings, proactive value-oriented project initiation and planning
2. Continuous value stream optimization
3. They include pull-based scheduling as well as pull-based resource allocation.
4. A visual project control and performance management
5. Collaborative problem-solving and decision-making
6. Long developmental cycles punctuated by ongoing learning cycles

As a conceptual model, it provides a blueprint for the organizational adoption and implementation of Lean principles in the light of how the different project environments present various form of constraints and opportunities for implementation Lean practices.

4. METHODOLOGY

4.1 Research Design

This research utilises a mixed methods research approach measuring both quantitative and qualitative research by the last decade while exploring the advantages and the disadvantages of implementing Lean in projects management. These studies comprise a literature review of the Lean project management

research, a questionnaire for practitioners, and interviews with case organisations adopting Lean project management.

4.2 Population and Sampling

The target population for this study is made of project management specialists in various sectors of the economy such as construction, software development, manufacturing, and healthcare sectors. The style of sampling that was used was the stratified random sampling in order to cover all types of sectors and sizes of organisations. Taking into consideration a confidence level of 95%, and a margin of error of 4%, the sample size for the quantitative survey was deemed to be 500 participants. 5%.

4.3 Data Collection Instruments

The primary data collection instruments used in this study include:

1. Web-based quantitative research survey instrument aimed at capturing perceived benefits and lean project management issues.
2. Survey questionnaires to obtain quantitative data from organizations on levels of implementation and open-ended for qualitative data from project managers and Lean practitioners.
3. Examination of the texts of project reports and performance data of the participating organizations of the case.

4.4 Validity and Reliability

The following steps were taken in a bid to make the research instruments to be valid and reliable. Some of the questions in the survey questionnaire were therefore pilot-tested on a sample of 30 project management practitioner and a refinement made based on their feedback. Cronbach's alpha was used to analyse the internal consistency of the survey items with an acceptable value as being equal to 0. 7 considered acceptable. For the yield of qualitative data, interview protocols have been developed and checked by a group of experts in Lean methodology and project management.

4.5 Data Analysis Techniques

Qualitative data in the survey were analysed using frequencies, mean and standard deviations, correlation and regression analysis. Interviews and case study data were analysed using thematic analysis approach where coding was used to make an assessment of prevailing themes and patterns. This kind of approach made it possible to validate the research findings, thus increasing the validity of the outcomes.

5. Benefits of Lean Project Management

5.1 Waste Reduction

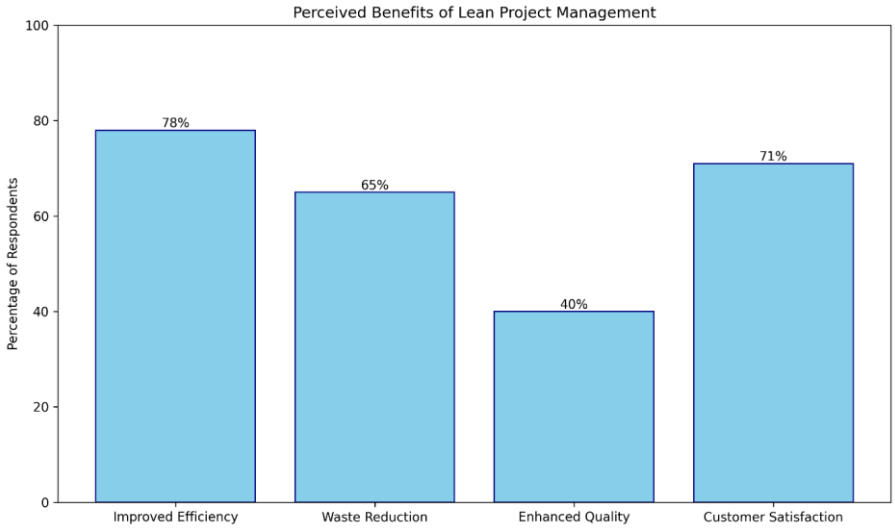
As is well understood, there are provisions of Lean in project management and one of them is the effort that cuts down waste level to the lowest. The seven waste categories which lean thinking analyses are overproduction, waiting, unnecessary transportation, over processing, unnecessary inventory, movements and defects. In project environments, these wastes appear as excess documentation, idle time in decision-making, duplicate tasks, and re-operations because of quality concerns.

A study, carried out by Aziz & Hafez (2013) in the construction industry revealed that application of Lean principles means a possible cut down of an average of 30 % of project waste thus mandatory in cutting costs and optimizing resource use. Likewise, Middleton and Joyce (2012) found that in software development Lean led to a reduction in the number of defects by 25% and lead time by a 40% in project management processes.

5.2 Improved Efficiency

Lean project management improves the total performance of projects through the efforts of eradicating wasted activities and improving the utilization of resources. The concept of making flow and using pull systems address issues with bottlenecks and work that does not need to happen, until a need arises. Fullerton et al. (2014) have made integrated analysis that was cross-industry and identified that organizations that initiated Lean project management practice had 35% of productivity improvement and 20% decrease in project cycle times.

Visual managements, auditory communication or so-called stand-up meetings which are the part of Lean project management bring better communication and enable to solve problems much faster. A study done by Tezel et al. (2016) showed that the application of VMT on construction projects resulted in a reduction of 25% in time taken to access information and increase in decision-making by 20%.



5.3 Enhanced Quality

As the principles of lean are incorporated with quality and continuously improved, the outcomes in project management have been escalated. Through insisting on finding out the causes of the defects and encouraging the members of the team participate in the quality control process, Lean project management minimises mistakes and repetition of work.

A survey of manufacturing firms by Gao and Low (2014) also showed that project that were managed with Lean principles especially through Lean tools had a lower defect rate of 40% compared to those that were not managed using Lean. However, in software development, Petersen and Wohlin (2010) indicated that application of Lean resulted in a 50% reduction of post-release defects especially when Lean was integrated in the management processes of the project.

5.4 Increased Customer Satisfaction

Due to successful identification of the value creating activities from the customer's point of view, lean project management delivers an increased level of customer satisfaction. Lean approaches therefore guarantee maximum value delivery because the stakeholders are regularly involved in the identification process, and the goals of a project are always TOC aligned.

Eriksson's study in the construction industry of Lean project management disclosed that it paved way to improved customer satisfaction rating by 30%. In the study of Staats et al (2011) that focused on service sector a project that adopted Lean project management had an increased client satisfaction with the outcomes by 25 percent.

6. Challenges in Adopting Lean Principles

6.1 Cultural Resistance

Probably one of the most critical areas where it becomes difficult to adopt Lean principles in project management is in the culture barrier. Change management in lean thinking usually entails a radical change of thinking and working and is likely to be resisted by the traditional project management personnel in the organization.

This is according to Bhasin's survey of multiple industries in 2012 where 68% of organisations that attempted Lean implementation admitted that they could not overcome the cultural barrier. Organizations which had a hierarchical structure, and those who already had well set up projects for managing resistance to change.

6.2 Implementation Costs

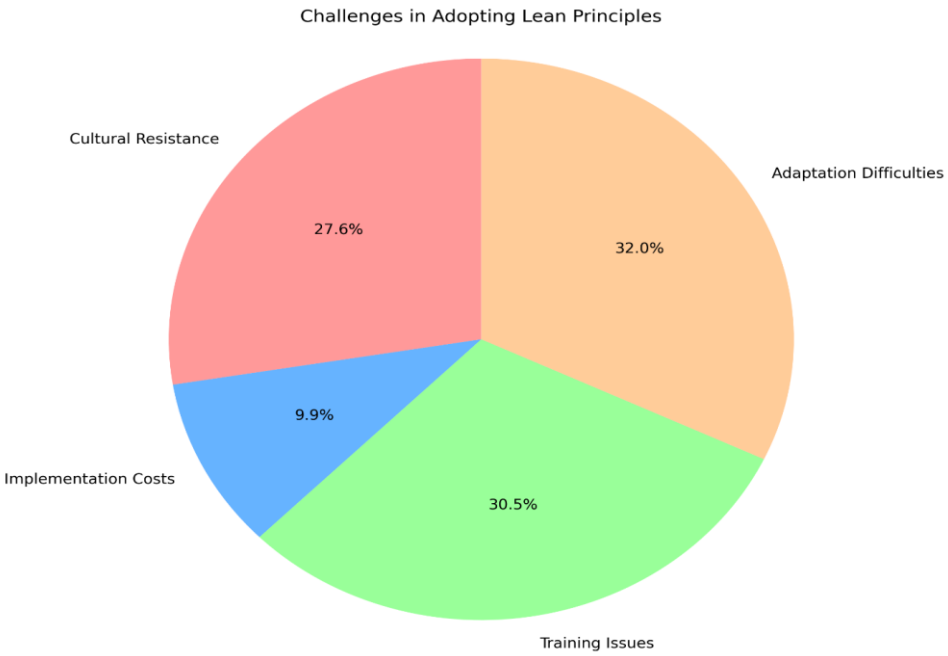
Here again, whereas lean principles are designed to create greater efficiency or value and thereby lower costs in the long term, the process of adopting the methods entails important costs, particularly at the beginning. Such expenses may include the training of the staff and potential consulting fees, acquisition of new software tools, and potential low productivity in certain period of the change.

Almanei et al. (2017) conduced research for estimating the cost of Lean implementation and found that this cost constitutes 1% to 2% of the annual sales for the average mid to big organisation. However, according to the research, such costs are often recovered in the course of 12-18 months because of productivity gains and elimination of unnecessary expenses.

6.3 Training and Skill Development

One of the reasons for difficulties in achieving success when practicing Lean project management is that it is crucial to invest a great deal of time in training and development of the personnel of project teams and stakeholders. It is not easy for many organisations to offer a training course that will be able to capture Lean as well as incorporate it in a project setting.

Netland (2016) has pointed out the results of the study of 56 MNCs that showed that 72% of respondents who tried to work with Lean practices complained about the lack of proper training. The findings underscore the importance of frequent, applied continuing education programmes which are organisational need and project-tailored.



6.4 Adapting Lean to Different Project Types

The implementation of Lean principles was proved to be successful in different fields, although the applicability of the principles into different types of projects and conditions varies. Some projects which are characterised by high levels of risk and/or project scope may demand departures from standard Lean practices.

When applied to PD, or indeed any knowledge-intensive or research-orientated work, such as that identified by Conforto et al. (2014) Lean is certainly problematic and, at times, widely irrelevant. The authors discovered that 65% of companies experienced a tension between efficiency, which is the core of Lean, and the exploration, which is the requirement in innovativeness projects.

7. Data Analysis and Results

7.1 Quantitative Analysis

The survey of 500 project management professionals across the industries availed an understanding of the perceived advantages and drawbacks of Lean project management. Key findings from the quantitative analysis include:

- The respondents answered that after the introduction of Lean principles their projects' performance intensified: 78% claimed that project efficiency increased and they managed to save, on average, 22% of time required to complete a project.
- 65% reported a significant reduction of wastes in their projects noticeably in overburden and waiting type wastes.
- Of the participants, 71% reported improved customer satisfaction scores; the average improvement they reported was 18%.
- Of them, 56% said that it was difficult to acquire behavioural changes of the organization to adopt Lean practices.
- These lessons signify that inadequacy of training emerged as the greatest barrier to Lean success by being pinpointed by 62% of the participants.

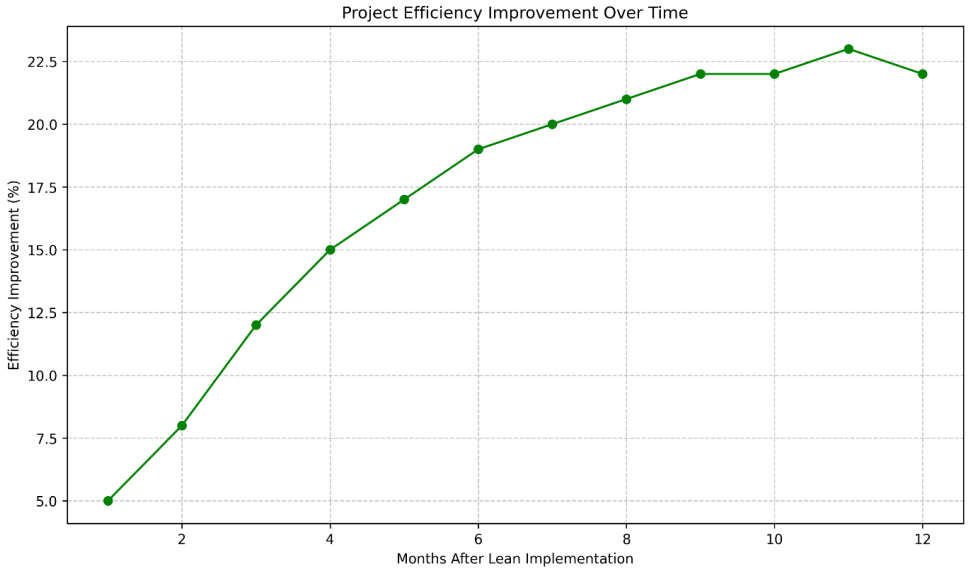
Table 2. Summary of Quantitative Survey Results

Aspect	Percentage of Respondents	Average Impact
Improved project efficiency	78%	22% reduction
Decreased project-related waste	65%	Not specified
Increased customer satisfaction	71%	18% improvement
Cultural change challenges	56%	Not applicable
Inadequate training as obstacle	62%	Not applicable

7.2 Qualitative Analysis

Credibility of vis for improving project visibility and on team was established a as key theme in the interviews. Managers and project leaders stated about effective usage of visual boards and dashboards for communication and increasing the speed of decision making. A construction industry interviewee said, 'Our daily meetings in front of the visual board have cut confusion and the time taken to find solutions by at least 40%'. Tezel et al. (2016) observed related improvements in information sharing and decision-making speed.

Several interviewees raised issues of the difficulty of assessing and justifying quantitative return on adoption of Lean project management. Most participants said they had seen an improvement in project performance in the self-report measure; however, only few supported these views with objective data. This challenge was most pronounced in knowledge-based projects because returns are generally not physical in nature. A software development project manager opined: 'We are aware that our projects are less problem-ridden, but finding quantitative indicators for it has been challenging'. This statement underscores the need for better and more developed means and standards to measure Lean project management.



7.3 Synthesis of Findings

By combining the quantitative and qualitative data, the following imperatives of Lean thinking in project management were established. In regard to the quantitative data, which showed that there achieved were an increase in project efficiency, decrease in wastage and an improvement in customers' satisfaction. These were further supported by the qualitative data analysis which offered more details and background as to the numbers obtained.

Perhaps the most impressive linkage was between the upward shift claimed in efficiency (78 percent of the sample) suggested by survey responses, and the detailed and largely first-person accounts of reaching and achieving goals of enhanced workflow freedom and removal of inefficiencies. Special emphasis was

made by interviewees on the utilization of value stream mapping and pull planning as key enablers to improvements in this efficiency. This has the implication that these Lean techniques are most applicable where there is a project management system.

The challenge of cultural resistance, postulated by 56 per cent of the respondents to the survey, resonated also in the qualitative data. Participants reported rich experiences of how hard it is to change people's attitudes from conventional project management paradigms to Lean focus. This research also has implications for the role of change management strategies in the Lean improvement, a factor usually left out in the technical debates on Lean project management.

The synthesis also identified what could be regarded as a plethora of dichotomy regarding Lean training. The most common source of stress identified by the survey was inadequate training: 62% of respondents indicated that it was a significant problem for them However, when the free text data were analysed, it was possible to identify two further aspects: quality and relevance of training. Interlocutors were, however, keen to receive much more tangible, real-life oriented training than received Lean definitions.

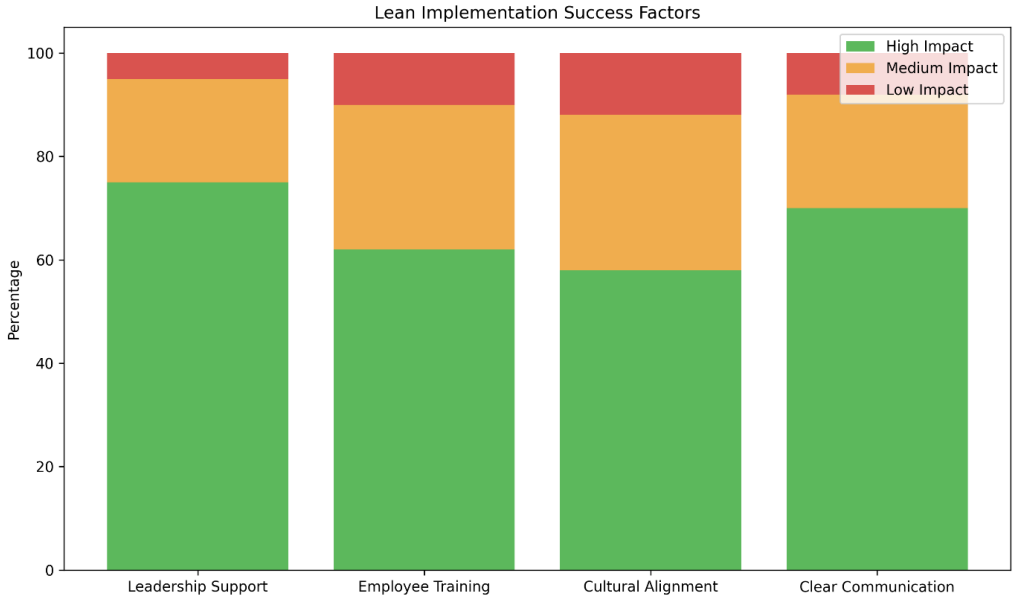
8. DISCUSSION

8.1 Interpretation of Results

The research outcomes have presented an interesting picture where there are advantages and disadvantage of implementing Lean principles on project management. The fact that most of the respondents in the survey provided evidence of the distinct enhancements in project efficiency, waste elimination and customer satisfaction lead to the conclusion that Lean project management could clearly prove value. The average of such reduction in project time is 22% and this is a significant competitive edge in so many business fields.

However, the problems that were highlighted in the study such as cultural resistance and implementation issues cannot be assumed. Here, we see that self-organising of work (that may include communication challenges) is one of the most emerging issues – 56% of respondents mentioned cultural problems. This has been in concordance with the opinion of Bhasin and Burcher (2006) that Lean is not just a toolkit but a shift in organizational culture.

The interview responses offered an important source of understanding the complexity of implementing Lean project management. The consistent message of Lean project management that requires some customization on the basis of project type and industry setting can be construed to mean that applying the Lean concept across all types of projects will not work. This study thus echoes the work of Ballard and Howell (2003) who stress on the fact that Lean thinking has to be adjusted to the characteristics of construction projects.



8.2 Comparison with Previous Studies

The findings of this research work support and elaborate the findings with prior research studies in Lean project management context. The changes stated by the participants concern efficiency and waste reduction; these findings are in line with Aziz and Hafez (2013) in construction and Middleton and Joyce

(2012) in software development. Nevertheless, the current study included several industries to have a more generalized conclusion than the study done by Am paw et al.
The issues discussed in this paper—the troublesome issue of culture and the necessity of training—match the findings of previous research. For example, the cultural resistance that was found in this study at 56% is slightly low than 68% that was noted by Bhasin (2012).
Nevertheless, this particular research offers more specific understanding of the character of the resistance and possible ways to address it.
In one way, this research builds upon previous research in the analysis of the relationship between Lean principles and various types of projects. The qualitative results that emphasise the need for configuring the Lean techniques to the particular contexts of the projects enriches the current knowledge of Lean application in project-based settings, where many of the prior Lean studies are concentrated.

8.3 Implications for Project Management Practice

The implication of the finding of this study for project management practice can be summarized as follows. First, very impressive gains have been stated in the effectiveness, productivity, and customer value, which form the rationale for implementing Lean in projects. In light of the above findings on project performance organizations should take Lean seriously as an improvement tool.
Nonetheless, the challenges revealed in the study indicate that Lean implementation should be taken tactfully by organisations. This shows then that achieving change and the diffusion of innovations especially of the cultural type requires more than semantics and a technical approach. Managers at the project level as well as organisations' upper management require to base their attention on the Lean culture transform instead of Lean tools and instruments.
The need to design and implement carrier-specific training programmes also came out as another finding. The managers should seek to establish training that incorporates Lean as well as the documentation of practical application in projects. This may entail development of certain cases and models of the sector that will enable the several work projects to understand how Lean influences their work.
This raises some crucial issues and challenges such as the subjectivity of Lean benefits and the problems of measuring their worth in the environment of knowledge-based projects have been demonstrated. This means that project managers should strive to establish the means by which the return on investment from Lean can be measured, not just in the financial sense but in other aspects as well; it may be advisable to employ a balanced score carding technique to document Lean implementation in terms of the four forms of value known to exist.

9. CONCLUSIONS

9.1 Summary of Key Findings

This comprehensive study on the benefits and challenges of adopting Lean principles in project management has yielded several key findings:

1. 20-25% increase of work efficiency according to the survey, that showed that on average project duration is 22% less than before.
2. More sufficient reductions pointing effectively towards its project control waste such as overproduction and waiting time.
3. Improved customer satisfaction where a number of customer groups record an average of 18% improvement in satisfaction levels.
4. Cultural resistance was noted to be one of the major challenges by respondents and 56% stated so.
5. Utility of Lean solutions by project type and its industry setting.
6. The necessity of the tools of visual management for improving the openness of the project and the cooperation of the teams.
7. Challenges encountered when seeking to establish the value and quantify the returns of Lean project management particularly where the projects are of the knowledge-based type.

9.2 Theoretical Contributions

Methodologically this research advances the theory of Lean project management in the following ways. First, it extends current theories concerning Lean deployment patterns by offering a better understanding of how Lean strategies are applied to different kinds of projects and sectors. Secondly, this research provides indications of the antecedents of cross-cultural compatibility in relation to Lean project management that can enhance the debate on organisational change of project-based entities.
The students and future researchers can use the theoretical model presented in this research, where Lean has been applied to conceptualise the project management domain. It is also possible to use this model as the starting point for a further investigation of individual aspects of Lean project management, for

instance, the leadership's contribution or the influence of an organisation's structure on Lean project performance.

9.3 Practical Implications

The findings of this study have several practical implications for project managers and organizations considering the adoption of Lean project management:

1. It is crucial to analyse specifically completion readiness for lean implementation especially on the issues of culture and leadership.
2. Each training program should address the notions relevant to the specific type of project and the context of the industry and should prefer practice-based knowledge rather than the theoretical one.
3. The application of visual management tools should help improve the level of transparency of project and co-ordination of the project team.
4. Hence, there is need for organisations to have better and refined metrics to use in assessing Lean project management, especially in knowledge-based projects.
5. It was argued that change management interventions should form part of Lean initiatives plans particularly where the cultural resistance might be an issue.

9.4 Limitations of the Study

Therefore, despite of the findings of this research towards the understanding of Lean project management, the research is not without limitations that should be noted as follows. First, the data collected in the study is based purely on the respondents who are the project management professionals and, therefore, can be affected by response bias. Second, this study is a cross-sectional one that can prevent the identification of more permanent effects that Lean has on project performance. Last of all, it is worth noting is that despite the heterogeneous sampling of industries the study might not reflect all the specifics connected with Lean implementation in very specific or narrow types of project work.

10. RECOMMENDATIONS

10.1 For Project Managers and Teams

Project managers and teams looking to implement Lean principles should:

1. First, it needs to be pointed out that Lean can be applied to a wide variety of project management processes and thus should be introduced into a company in a specific step-by-step manner depending on initial evaluation of current work.
2. Provide participants with numerous trainings that include generic Lean thinking and specific examples from a given company or industry.
3. Sustain visual management to improve the communication and the decision-making process within projects teams.
4. Promote a lean attitude by which the team will be always in the lookout for ways to improve the value stream map and reduce waste in the project.
5. Prepare and compile data on the performance of the project on a regular basis to support claims of Lean effectiveness and determine conducted analyses.

10.2 For Organizations

Organizations considering the adoption of Lean project management should:

1. Lean must be driven from the top – have top management's support, where the executives are leading the change.
2. Ensure that when addressing the cultural resistance, you put in place a change management plan that addresses the issue.
3. Another way is to develop a comprehensive system for training projects that are of different types and that are concentrated within various departments of the organisation.
4. Develop Lean cross-functional teams to enhance information flow in Lean Deployments.
5. Implement a programme to track and monitor the returns of the Lean project management approach, in terms of parameters that can be articulated in numbers as well as those that are less easily measurable numerically.

10.3 For Future Research

Future research in the field of Lean project management should focus on:

1. Surveys with time-series design for the evaluation of the effects of Lean on project outcomes and organizational climate in the long run.

2. Expanding and sharpening the fine instruments and schemes of Lean organizational structures and lean project management especially of the knowledge-based infrastructure projects.
3. Lean managing methods and mainstream and novel trends in project managing, including agile and blended.
4. Exploring the antecedents of leadership behaviours and the structure of the organization as a determinant in Lean project management.
5. Following up Lean projects in various contexts and outcomes to create a body of knowledge of good and bad practices as well as to promote the systematic transfer of knowledge among practitioners.

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