

CASE STUDY IN THE APPLICATION OF THE LAST PLANNER® SYSTEM

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ABSTRACT

The purpose of this paper is to identify the perceived benefits and challenges in the application of the Last Planner® System (LPS) in an Irish context. A case study research method was applied to one Irish case study organization. Qualitative and quantitative data was analyzed from primary and secondary data. Limitations of the study include utilisation of a single case study and the part time role of the researchers. Five key perceived benefits of LPS were identified including; Improved planning accuracy, Real time control, Proactive control, Engagement, and Design quality for construction. One key challenge identified, was a lack of time required for implementation. Insufficient training and resistance to change were not found to be issues compared to the literature review. Two different challenges were identified including lack of customization to suit different client sectors and lack of a standardized approach to deployment across projects. Further research is recommended to (a) understand these additional challenges (b) follow up of this study in the future of the case organization and (c) include additional Irish case studies.

KEYWORDS

Lean construction, last planner® system, lean, construction.

INTRODUCTION

GLOBAL AND IRISH CONTEXT

The global construction sector is experiencing positive growth (Turner and Townsend 2018). This growth is driving increased demand for skilled labour which drives prices and increases pressure on productivity (Turner and Townsend 2018). In parallel, projects are becoming more technically challenging, clients are becoming more demanding and contracts are becoming more complex (Koskela 2014). Construction Productivity increases have lagged other industries McKinsey (2017), presented in Figure 1. The Irish experience directly mirrors this with construction costs in Dublin expected to increase by 7% in 2018 (Turner and Townsend 2018). Skills shortages affecting main contractors, specialist Sub-

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contractors and Architects mean that prices are expected to equal 2007 boom time prices, in 2019 (Linesight 2019).

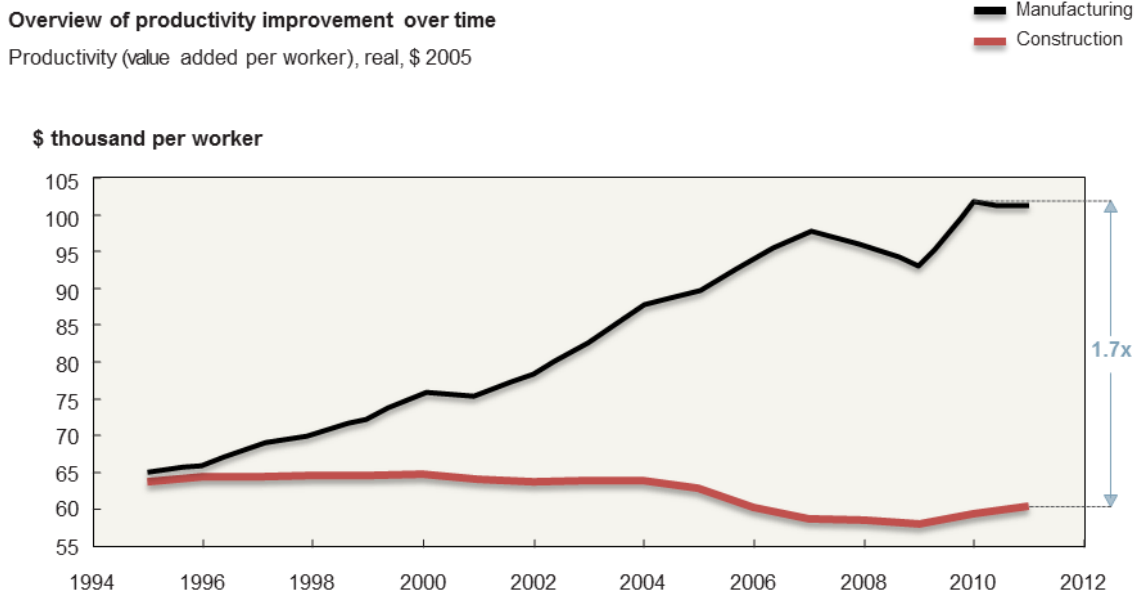


Figure 1. Construction productivity compared to manufacturing productivity 1995-2012
McKinsey (2017)

LITERATURE REVIEW

THE ORIGINS OF LEAN AND LEAN CONSTRUCTION

The term lean production was first popularised by the seminal book “The Machine that Changed the World”, published by Womack, Jones and Roos (1990). The book highlighted the significantly higher levels of performance from Toyota as compared to the rest of the automotive industry. At Toyota, Taichi Ohno had already spent many years developing what became known as the Toyota Production System, drawing influences from many sources including the American Supermarket system upon which Just in Time (JIT) concept was based (Ohno 1988). The evolution of the Toyota production system mirrored that of the Total Quality Management paradigm originating in the USA, travelling to Japan and then being disseminated to the rest of the world from there. There are many detailed accounts of the origins of Lean and its subsequent transformations in the literature Holweg,(2007) Shingo, (1989),Samuel Found and Williams (2015).

Lean Construction then, is the application of the concepts of the Toyota Production System to the Construction Project context. The drivers for applying Lean in Construction have been described citing objectives such as waste elimination, process control, flexibility, value to the customer (Ross and Associates 2004). The adoption of “Lean Construction” has been cited as a potential solution in the Irish Context (Ebbs et al 2015).

To close the productivity gap, McKinsey (2017) recommend a focus in improving the project planning and execution process. Issues within the project management process have been well documented in the literature Howell and Koskela (2000) Sundararajan and Madhavi (2018). Koskela et al (2014) highlight issues with the widely used Critical Path methodology for project planning and control within the industry. LPS is often viewed as the basis for Lean Construction (Daniel et al 2015).

LAST PLANNER® SYSTEM

The Last Planner® System (LPS) focuses on the creation of predictable and reliable workflow in construction production Mossman (2018). It was developed in 1992 by Glen Ballard and Greg Howell with the following five Stages

1. Milestone Planning
2. Phase/Pull Planning
3. Make Ready/Lookahead Planning
4. Weekly Work Planning
5. Doing and Learning

The Lean Construction Institute, LCI (2015) reports that the adoption of the Last Planner® System is growing. Daniel et al (2015) found that USA and Brazil have the highest implementation of cases, 37, with 11 cases reported from Norway, UK and Finland feature from a European perspective. There were no cases reported from an Irish perspective.

Viana et al (2010) found that 95.5% of the practitioners interviewed perceived improvements as a result of LPS. To understand the benefits and challenges of the Last Planner® System, a literature review was completed across 61 cases from the USA, Asia and Brazil, Chile, United Kingdom, Finland and New Zealand. The timeframe for these cases range from 2002 to 2016.

Table 1 summarises the benefits of the LPS from the literature review across a variety of client types. The topmost benefits include improved project delivery, more reliable planning and expansion of knowledge by the entire team.

Table 1. Perceived Benefits of the Last Planner® System

Number	Benefits	Source
1	Improve project delivery / reduce production time	Fernandez-Solis et al. 2013; Viana et al (2010); Alarcón et al (2002); Fiallo et al (2002); Mejía-Plata et al (2016)
2	More reliable planning	Fernandez-Solis et al. 2013; Johansen et al 2010, Viana et al (2010); Johnansen et al (2003);
3	Knowledge expansion and learning among project teams	Fernandez-Solis et al. 2013; Viana et al (2010); Alarcón et al (2002)
4	Improved Communication within team	Fernandez-Solis et al. 2013; Viana et al (2010)
5	Improved supply chain integration	Fernandez-Solis et al. 2013; Alarcón et al (2002)
6	Enhancement of managerial practices in construction	Fernandez-Solis et al. 2013; Viana et al (2010)
7	Improvement in quality of work practice at construction site	Fernandez-Solis et al. 2013
8	Less Firefighting or fewer day to day problems	Fernandez-Solis et al. 2013

Table 2 summarises the key challenges from the literature review. Resistance to change, lack of experience and training on the system and lack of time to implement the system are the topmost challenges cited.

Furthermore, in a similar study of the challenges, Porwal et al (2010) identified challenges including resistance to change and lack of training reported within the top three challenges presented.

Viana et al (2010) investigated the perceived benefits and challenges, in Brazil, from the perspective of three managerial levels; site engineers, foremen and crew leaders. The research found that perceived benefits were similar across all 3 levels. In terms of challenges, Engineers identified their primary challenge as lack of time for planning whereas Foremen perceiving the change of culture as the primary challenge. While a difference in perspective, both challenges feature in the top 3 challenges identified in Table 2.

Table 2 Perceived Challenges of the Last Planner® System

Number	Challenges	Source
1	Resistance to change	Fernandez-Solis et al. 2013; Mejía-Plata et al (2016); Hunt et al (2018); Alarcón et al (2002); Viana et al (2010); Koskenvesa et al (2005)
2	Lack of Experience of LPS / lack of training / Quality of information	Fernandez-Solis et al. 2013; Mejía-Plata et al (2016); Alarcón et al (2002); Viana et al (2010); Johansen et al 2010
3	Lack of time to plan / implement	Alarcón et al (2002); Viana et al (2010); Johansen et al 2010
4	Misinterpretation of PPC indicator	Fernandez-Solis et al. 2013; Alarcón et al (2002)
5	Partial or Late implementation of LPS	Fernandez-Solis et al. 2013; Hunt et al (2018)
6	Short term vision	Fernandez-Solis et al. 2013; Alarcón et al (2002)
7	Lack of stakeholder support	Fernandez-Solis et al. 2013; Mejía-Plata et al (2016)
8	Poor use of information generated during implementation	Fernandez-Solis et al. 2013; Viana et al (2010)
9	Lack of commitment/leadership to LPS implementation	Fernandez-Solis et al. 2013, Hunt et al (2018)
10	Bad team chemistry or lack of collaboration	Fernandez-Solis et al. 2013

The above literature review highlighted a dearth of cases reported from Ireland. To address this gap in the literature, the researchers focus their investigation into the benefits and challenges of Last Planner® System within an Irish context. In doing so, both from an economic and academic perspective, this research seeks to further add to the body of knowledge around the Last Planner® System. The research focuses on two additional perspectives. This first is to consider the perspective of two client segments; Pharmaceutical and Fit Out, to compare findings. The second perspective layered into the research is from the perspective of two levels within the organization; Leadership and Direct employees, building on research by Viana et al (2010).

RESEARCH METHODOGY

Case study research methodology was selected as the research instrument within one organisation (Yin 2009). The primary data came from qualitative data collection from an online survey (Fowler 2013). The secondary data was taken from analysis of a pilot project undertaken within the client company in 2015 yielding useful quantitative data. Case studies have become one of the most common ways to do qualitative research (Stake 2003). An evidence-based approach from the literature review, summarised within Table 1, Table 2 and Viana et al (2010), was utilised to provide a framework for the survey design. The survey included both open and closed questions to elicit an analysis of perceived benefits and challenges of the LPS within an Irish context.

The survey was sent to two sub groups in terms of management Levels at case organisation; Leadership and Direct Staff. Leadership include Operations Managers and Directors. Direct Staff include Site Managers, Project Managers and Staff reporting into these roles. These sub groups were designed to facilitate a comparison to Viana et al (2010) research.

Two client sectors within the case study were selected; Pharmaceutical and Fit Out. The survey design included a question to identify the client type that the participant supported. This question allowed for the comparison of the perceived benefits and challenges of the LPS between client sectors supported by the case study organisation.

Reliability of qualitative data was designed into the survey through closed questions and the survey was piloted and refined (Fowler 2013). Additional questions were included in the design to ensure validity of the qualitative data.

A critical analysis of data collected was completed by two of the researchers, who are independent External Consultants of the case study organisation. Qualitative data collected were analysed using a thematic analysis (Braun et al 2006). Secondary data was also available from a pilot project undertaken by the case study company, which is also included in this research.

LIMITATIONS

Limitations of the research is recognised by the researchers including a single case study organisation, part time nature of the researchers and a small sample size. Limitations of the research were mitigated per Hines et al. (2018).

CLIENT ORGANISATION

Ardmac is an Irish Construction company that deliver high value workspaces and technical solutions. It supports customer sectors including Pharmaceutical, Fit Out, Design and Build and Data Centres across Ireland, UK and Europe. Ardmac adopted the application of the Last Planner® System in 2015, starting with a project within the Pharmaceutical sector. Leadership fully committed to the deployment of the Last Planner® System, with all

projects mandated to use this system from the start of 2018. All Employees using Last Planner® were trained on the application of the LPS.

KEY FINDINGS

RESULTS AND ANALYSIS OF BENEFITS OF THE LAST PLANNER® SYSTEM

The survey was delivered on line to 250 people, of which 49 respondents used the Last Planner® System from both Leadership and Direct Employees. Both Pharmaceutical and Fit Out client sectors were represented in the data collected.

From the analysis of the data presented in Table 3, 92% of respondents perceived the LPS is of benefit which is aligned to 95.5% of respondents from Viana et al (2010). From this study, There is a 12% difference in perception between Leadership and Direct Employees, with Leadership more positive compared to Direct Employees.

Table 3 Percentage of Participants who Perceive LPS as Beneficial

Group	LPS	Pull Plan	Constraints Log	Weekly Work Plan
All Respondents	92%	94%	98%	98%
Leaders	100%	93%	100%	100%
Employees	88%	95%	96%	98%

Reliability of the data is supported, with the perceived benefits of the individual elements of the LPS comparing favourably to the overall benefit of the LPS (94%, 98% and 98% for Pull Plan, Constraints Log and Weekly Work Plan respectively compared to 92% overall %).

The perception of participants that support Pharmaceutical and Fit Out sectors are presented in Table 4. Participants that support Pharmaceutical clients perceive the LPS to be of more benefit when managing LPS projects compared to the shorter lead time projects within the Fit Out sector. Participants from the Pharmaceutical sector are aligned with Viana et al (2010) research of 95%. Fit out projects are 17% less than Viana et al (2010) research.

Table 4 Perception of the benefits of the LPS across two client sections

Sector	% Perceive LPS beneficial
Pharmaceutical	95%
Fit Out	78%

From the thematic analysis of the perceived benefits in Table 5, five key benefits were identified; improvement in planning accuracy, improvement in real time control of a project, improved proactive control, improved engagement and improved design quality for construction. 61% of respondents identified improved planning and real time control as the top 2 benefits of the LPS. This finding is similar to the findings from Fernandes-Solis et al (2013) and the literature review summary in Table 1, where more reliable planning was considered a key benefit. It was noted in Table 5 that Leadership place more emphasis on improved planning accuracy compared to Direct Employee responses.

Other themes noted in Table 5, that align with the literature review in Table 1, include improved proactive control and less firefighting resulting from a Last Planner® System approach. Real time project control in Table 5 from the case study aligns with improved communication from the literature review and improved communication in Table 1.

Table 5 Benefits of the Last Planner® System

Benefits of Last Planner® System	All Responses	Employee Responses	Leader Responses
Improved Planning Accuracy	40%	24%	55%
Improved Real-Time Control	21%	33%	9%
Improved Proactive Control	19%	19%	18%
Improved Engagement	14%	14%	14%
Improve Design Quality for Construction	7%	10%	5%

When comparing the improvement in quality, it was noted that while the case study findings were similar with respondents perceiving an improvement in quality, what was different was the focus in improvement. The focus for the case study highlighted that there was an improvement in Design quality from Table 5. From the literature, Fernandes et al (2013) within Table 1, presented the focus on an improvement in quality of work practices at the construction site.

RESULTS AND ANALYSIS OF CHALLENGES OF THE LAST PLANNER® SYSTEM

From the thematic analysis of perceived challenges, five key themes are summarised in Table 6 as follows; lack of full engagement, lack of customisation to suit client type, lack of time to implement, person versus process focus with PPC indicator and lack of standardisation across projects.

Table 6 Perceived Challenges with Last Planner® System

Challenges of Last Planner® System	All Responses	Employee Responses	Leader Responses
Lack of Full Engagement	31%	18%	40%
Lack of Customisation to suit client type	23%	55%	0%
Lack of Time to Implement	19%	9%	27%
Other	12%	0%	20%
Person versus Process Focus when using PPC indicator	8%	9%	7%
Lack of Standardisation across projects	8%	9%	7%

When compared to the literature review, the case study findings in Table 6 align with the challenges outlined in Table 2 and cite lack of time to implement the LPS (19%) in the top 3 challenges. Lack of full engagement represents 31% of the key themes identified in Table 2, which aligns with resistance to change from the literature in Table 2.

In contrast, the case study organization highlights a number of different challenges with the Last Planner® System. While lack of training features in the literature in Table 2, it was absent from the case study challenges. It is noted that 100% of participants in the case study company have all received LPS training. This may provide an insight into why training was not identified as a challenge at the case study organization.

Table 6 identifies a second difference to the literature review in Table 2. The case study identifies lack of customisation across projects as a challenge, which is not evident in the literature. This lack of customisation may explain the 17% difference in perception between client sectors reported in Table 4. The case study organization operates in different client sectors, with the data indicating that customisation of the system may be required to meet different client sector types. A third difference identified in Table 6 was a lack of standardisation across projects compared with the findings in Table 2.

ANALYSIS OF SECONDARY DATA

Table 7 summarises the quantitative benefits for the first Last Planner® System project completed in 2015 (Lean Construction Ireland Book of Cases 2018). From the data presented, there are significant quantified results present in the areas of Safety, Quality and Labour ratio.

Table 7 Benefits from the Implementation of the Last Planner® System (LCi Book of Case Studies 2018)

Metric	Improvement
Safety	Zero first aids / near misses
Quality	Reduced no of defects at client walkdown from 9 to 3.4
Labour Ratio	10% reduction in Labour to budget ratio

CONCLUSIONS AND RECOMMENDATIONS

With the global and Irish construction sector experiencing growth, the adoption of the Last Planner® System is also growing. A literature review was completed, and both the perceived benefits and challenges of the System were identified. Case study research was completed within one case study organization and the perceived benefits and challenges were compared to the literature review. 95.5% of cases analysed by Viana et al (2010) compared to 95% of the case study research agree that the Last Planner® System is of benefit. Key benefits identified from the literature and the case study were aligned with improved project delivery, more reliable planning and improved engagement cited in both. Secondary data presented the benefits from one project, with improvements in safety and quality cited. Time to implement was identified as a common challenge between the literature and case study. The case study presented different challenges including lack of customization to suit a client sector and lack of standardization. The limitations of the study are acknowledged, including part time researchers and application to one case study organization. Further research is recommended both from an Irish context and also to investigate further how to overcome the challenges identified from the case study.

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