42nd AUBEA CONFERENCE 2018
Australasian Universities Building Education Association (AUBEA)

EDUCATING BUILDING PROFESSIONALS FOR THE FUTURE IN THE GLOBALISED WORLD

INNOVATION

VOLUME 1

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Cisco Provider Code 003013
42nd AUBEA CONFERENCE 2018
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26 - 28 September 2018
Singapore

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CURTIN UNIVERSITY
ACKNOWLEDGEMENTS

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already struggling to keep up with demand (MBIE, 2017). With the industry growing at such a rate, innovative approaches are required to increase efficiency and productivity.

A key element in this innovation is the use of management tools which allow for greater levels of planning, leading to faster delivery times and reduced waste. Although Lean Construction principles are not new in the international context, their implementation within the New Zealand industry has been limited in the past and are only slowly being taken up by companies seeking better ways of managing the needs of the current construction environment. In particular, Last Planner System (LPS) is increasingly seen as one of the most accessible and readily implemented approaches to improve project performance. As a result, adoption of LPS has been gaining momentum with main contractor companies in New Zealand over the last few years. Overcoming the “not invented here” syndrome is a challenge, however, with many in the industry looking for more evidence of local application before moving to adopt the approach.

In order to help address this need for local substantiation of international practice, this research looked at the experience of two specific stakeholder groups with LPS: main contractor and subcontractor employees. The generic structure of the commercial construction industry in New Zealand is focused around main contractors that act in a construction management role, while subcontractors deliver the labour and trades on the project. This means that the relationship between the main contractor and subcontractor employees is critical to the success of any commercial project delivery, thus the choice to focus on these two stakeholder groups. The perspectives of both groups are necessary to allow analysis of barriers and facilitating factors to the implementation of LPS, particularly through identifying where these views overlap or diverge.

2. Literature Review

The primary function of LPS is to “successfully reduce construction waste” (Song and Liang, 2011, p. 350). Waste in this instance includes unnecessary and unproductive use of any resource, including production, time, transportation and materials. LPS uses 4 main planning tools in order to reduce waste: master plan, pull plan, look ahead plans and weekly work plans (Pheng and Shang, 2013). These tools are all utilised at different stages of the project, targeting specific issues that may arise. According to Aziz and Hafez (2014), the work completed in the construction industry is rework, and the industry itself is only running at 40-60% labour efficiency. The look ahead planning and weekly work plans of LPS seek to combat this deficiency. The tool identifies tasks that need to be completed in order to allow other critical tasks to be undertaken. Fernandez-Solis et al. (2013) state that this type of planning results in a reduction of non-value adding activities while AlShaehim et al. (2014) identified increased productivity and greater workflow reliability in their case study as the key benefits of this planning management tool. By forecasting the required tasks for a project, alongside with any critical milestones that they correspond to, the management team of a project are able to best allocate resources on a day-by-day basis to ensure that no trade is being held up by another trade (Song and Liang, 2001) resulting in better work flow dynamics and continuous productivity.

One of the key benefits of LPS as a whole is the greater level of collaboration between onsite workers and management staff (Alarcon et al., 2008). Onsite workers, known as the ‘last planners’, are given the responsibility of updating the weekly work plan, which is forecasted for a period of up to 6 weeks in advance. In the traditional context, this planning was previously left to onsite management to initiate, the required tasks were ‘pushed’ onto the workers and the workers simply performed the task as and when they were told. LPS aims to change this by using the pull method instead, where the workers pull the essential tasks along for the progression of the whole job. This concept also allows for better overall planning of the project as the workers have the most knowledge regarding how long a particular task will take as well as knowing what is required prior to that task taking place. Placing a greater level of responsibility in the hands of the workers allows for a more personal connection to the project and goes on to foster a greater sense of commitment to the project from the workers, increasing labour productivity and thus allowing for more favourable delivery timeframes (Kalsaa, 2012). When management encourages this connection, onsite workers are likely to respond in a positive way, leading to other positive impacts such as workers contributing to problem solving discussions regarding issues on site and contributing a greater variety of solutions (Alarcon et al., 2008).

This strength of a culture change is also one of the key challenges of LPS implementation. The two main implementation challenges of LPS implementation are organisational inertia and resistance to change (Fernandez-Solis et al., 2010). The initial implementation is down to the project management team, but LPS relies heavily on the knowledge of the onsite workers to succeed, so both parties need to be engaged for successful use of LPS. If the management team is shown to be reluctant to change and unwilling to implement new tools for improvement, the onsite workers will feed off of this energy and will also determine that tools like this are of no benefit to them (Kalsaa, 2012). Kalsaa (2012) identifies that the culture needs to evolve from “this is how we have always been” to “how can we become better” with a very difficult to achieve, especially when there is a great deal of resistance from external sources such as clients and subcontractors, who simply focus on the end product instead of the processes and improvement for future projects.

Another significant challenge in implementing LPS is its relative newness within the construction industry. According to Fernandez-Solis et al., (2010), the whole lean concept is new to construction, and a lack of education surrounding the topic means that employees can be wary and reluctant to implement the changes. Lack of training and education can also lead to partial or late implementation of LPS where its contribution to a project might not be fully appreciated (Fernandez-Solis et al., 2010). Alarcon et al., (2008) argues that while a lack of education surrounding LPS is an issue in adoption, a lower level of knowledge also results in a lack of self-critiquing, which is a bigger barrier in implementation. Implementers of the tool are not willing to accept criticisms regarding their systems and often take the criticism in a negative light. The review process in this case becomes redundant, which causes a certain level of stagnation in the improvement of the system.

Perhaps the greatest barrier to LPS identified in the literature is the relationship between sub-contractors and main contractors. Fernandez-Solis et al. (2010) argues that bad chemistry has often developed because parties have previously worked on projects together with difficulty. This preconceived negative attitude can translate from one project to another, meaning that collaboration is difficult to achieve. Hanzeh (2011) also argues that incompatibilities between different personnel on site are at the core of barriers to achieving a collaborative relationship. Kalsaa (2012) suggests that a shift from fixed work identities needs to occur, especially regarding management teams. Hierarchical identities create a divide between the parties where the onsite workers do not feel comfortable to initiate the conversations that LPS requires. LPS relies on a cultural shift from the traditional “management versus workers” culture to one where the parties function as a collaborative unit with a common goal.
3. Research Methodology

The research was carried out using a qualitative survey, based on questionnaires with multi-choice and short answer questions. A qualitative approach was appropriate for this research as it was focused on the opinions and experiences of the different participants (Denscombe, 2010). The aim of the questionnaire was to collect data that would allow identification of trends and patterns between individual participants, and also between the two different stakeholder groups.

Two separate stakeholder groups were surveyed: main contractor and subcontractor employees. LPS calls for a collaborative relationship between these two stakeholder groups to be implemented; therefore, obtaining data from representatives of both these groups was essential. There were 24 participants in total, 12 from the main contractor group and 12 from the subcontractor. Participants were selected from a range of commercial construction sites, within Auckland, that actively use LPS as their primary management tool. The participants varied in their levels of experience, ranging from one year in the construction industry to 20+ years of experience. There was also a variety of roles across the participants, including project managers, quantity surveyors, package managers, cadets and on-site trade workers. The range of roles ensured that a variety of perspectives were obtained, instead of focusing on subgroups of workers in the two stakeholder groups.

The questionnaire comprised two different sets of questions. The first set established the participant’s level of experience in the construction industry and their level of involvement in LPS. This was used to ensure that there was a range of participants from each group with different levels of experience and involvement. The second set of questions (see Appendix A) was focused on LPS as a whole, and included a set of statements using a rating scale for the participant to identify how they felt about the statement. This was followed by four short-answer questions which allowed the participants to further expand on their opinions and ideas surrounding LPS. The questions were designed to only allow positive or negative responses from the participants regarding their attitudes and perspectives surrounding LPS as a whole and its implementation on their sites. Removing a neutral option from the questionnaire meant that not only could conclusions be drawn from the responses but particular barriers could be identified, allowing for actions to be implemented in the future to combat these.

The choice to use a questionnaire with multi-choice options over structured interviews stemmed from the fact that LPS is a very young management tool in New Zealand. While all the participants that were chosen for the research do have some experience using LPS, this experience is varied. Utilizing an interview approach may have introduced concepts that the participants were not familiar with, and a potential lack of understanding around this may have resulted in dishonest answers, particularly in a face-to-face situation where participants may not have wanted to appear ignorant of the concepts (Denscombe, 2010). The questionnaire focuses on basic concepts and opinions of LPS and while the data collected may not be as in-depth as that gained through a structured interview, it provides sufficient basis for an exploratory view of LPS adoption.

4. Findings and Discussion

4.1 Contractor involvement

The Main Contractor (MC) group considered that there is not enough ‘buy-in’ to LPS from the subcontractors. Their response to the statement ‘I feel that LPS could be implemented more effectively’ indicated that all the MC participants felt that there was room for improvement – no participant disagreed or strongly disagreed with this statement. Whithask et al. asked to identify the biggest fault with LPS, 7 out of 12 MC participants identified a lack of subcontractor involvement and participation. Previous studies have emphasised the need for subcontractor participation. Fernandez-Solis et al. (2013) state that external resistance from subcontractors results in ineffective implementation of the tool. Similarly, AlSehami et al. (2014) state that in order for LPS to be implemented effectively, the involvement of the subcontractors needs to be the norm, and part of the ingrained culture within a project.

In the questionnaire statements ‘LPS takes too much time to implement on site’ and ‘Sites are already busy enough, there is no time for the additional administrative work required for LPS’, the response from both groups was predominantly negative, suggesting that they were provided with sufficient time to undertake the LPS process. Alarcon et al. (2008) found the opposite in their study, which identified that the last planners on site (subcontractor workers conducting the onsite work) were resistant to using LPS due to the time it took to implement any new processes. This idea was further reiterated by Fernandez-Solis et al., (2013) who found that external resistance from clients and subcontractors rose from perceived time implication issues. The Auckland commercial construction participants did not answer as the literature would indicate in this regard. However, when asked to list negative aspects of LPS, several participants stated that they felt there was too much administration involved in the system. From this it would appear that although participants had sufficient time to undertake the processes, they still considered that the processes themselves were unnecessarily time-consuming.

4.2 Formal training

Both stakeholder groups identified a lack of formal training as a barrier to better use of LPS. While some of the participants identified that training and information is lacking for all parties involved in using the system, 4 of the 12 MC participants considered that there is not enough training provided to subcontractor workers specifically, resulting in workers not being engaged in the process. This again reflects what was seen in the literature; for example, Alarcon et al. (2008) found that a lack of training and understanding of key processes of LPS was one of the major barriers to successful adoption. In this case, only half of the MC participants had received formal training in the use of LPS, and half of the participants also stated that they would be more likely to use LPS if they had completed some form of training around the topic. This contrasts with the SC stakeholder group, where none of the participants had received any formal training in the key components of the tool or LPS as a system. Every participant in the SC group stated that to a certain degree, they would be more willing to use LPS onsite if they had been provided with training. The lack of education provided to subcontractors indicates that within Auckland, main contractors are the driving force behind the implementation of the tool but the drive is predominately to members of their own company, instead of facilitating any training to their subcontractors. Main contractors are now commonly requiring subcontractors to attend a pre-programme workshop (a key aspect of LPS) as part of implementing LPS on a project. However, if the subcontractor involved does not have a clear overview or training in the tool, these pre-programme workshops may have less impact than desired.
This opens up the issue of who should be responsible for administering the training to LPS users. One argument is that if the main contractor requires the subcontractors to use the tool, it becomes their responsibility to ensure that the subcontractors then receive appropriate training. Another view is that formal training should be undertaken by the subcontractors themselves, as this is a skill set that will be used for future jobs and projects. The lack of education around the topic of LPS, and lean construction as a whole ideology, was the most common barrier indicated in the literature (Aziz and Hafez, 2013; Fernández-Solis et al., 2013).

4.3 Attitudes towards implementation

The construction industry is very conservative and inherently resistant to change (Song and Liang, 2011). Traditionally, the roles of main contractor and subcontractor workers have been segregated. LPS requires a collaborative effort from both main and subcontractor, so this is a barrier that needs to be addressed in order to ensure that LPS can be effectively implemented. Kalsas (2012) states that it will take time for everyone to break out of this mentality, for everyone to “find it natural and desirable to participate…where they have to be more involved” (p. 96). The perceived view is that subcontractors are wary of main contractors and their motives on site, so calls for collaboration are treated as potentially not genuine (Akintan and Moreledge, 2013). Based on the literature, the expected result of this study was that the use of LPS, imposed on subcontractors by the main contractor, would be undertaken with some trepidation. On the contrary, however, the majority of responses from the subcontractor group were in support of the use of LPS on sites. The questionnaire statement ‘I feel like LPS has been used to its fullest potential on my projects’ elicited a more positive response from the SC participants than from the MC participants (9 SC and 3 MC participants), which indicates that the SC group has a more positive outlook on the LPS process as a whole.

The responses of the SC group to other questionnaire statements were similarly positive, and none of the barriers that they identified were related to perceived negative connotations. However, this may be related to the SC participants’ lower level of formal training. Because the MC participants have more formal knowledge surrounding the tool, they may thus have a more realistic expectation of what LPS has the potential to achieve. The SC group, on the other hand, may feel that LPS is being used to its full potential but may have less knowledge and lower expectations of what it should achieve.

The MC responses also indicated a positive view of the use of LPS; however, their views seemed to centre more around how it could be beneficial if appropriately implemented in the future, rather than its use in the current market. The MC participants identified that a major barrier for implementation from their perspective was a lack of subcontractor buy-in. When considering this view alongside the attitude of the subcontractor group, there seems to be a disconnect between what each group perceives as the attitudes of the other group.

4.4 Conflicting Findings

Participants were asked about their familiarity with all aspects of the LPS system, and how comfortable they were with using the corresponding tools. The expected result of these two questions would be a correlation between the two, that is, a positive reaction in the familiarity question should yield a positive response in the following question. However, only 7 of the SC participants indicated that they were familiar using all aspects of the tool (7 agree, 0 strongly agree). When answering how comfortable they were using all tools in the system, the response was significantly more positive (8 agree, 1 strongly agree). The current research did not investigate participants’ level of knowledge about the possible usage of LPS, which may be a concern for regarding participants’ awareness and understanding of LPS tools. In any case, if participants do not have knowledge in all aspects of the tool, it seems contradictory to state they are comfortable using all the tools.

A conflict in the opinions and perceptions of the two groups is focused around whether LPS has been utilized to its fullest potential on projects. Aziz and Hafez (2013) found that one of the main challenges to implementation of LPS is the fact that currently it is main contractor management driven, resulting in subcontractor workers feeling uninvolved and uninspired by the process. Therefore, the expected conclusion would be that the MC participants would have a more positive response to whether LPS is being used to its fullest potential. However, the research indicated that SC participants have a more positive perception of this statement (3 participants strongly agree, 6 agree) than MC (0 participants strongly agree, 3 agree). These findings could be again explained by the low level of training received by the two stakeholder groups. In the MC group, 6 participants had experienced some form of formal training of LPS, but none of the SC group had received any. The lack of formal knowledge on the part of the SC participants may have resulted in a false level of confidence regarding their understanding of the system. Furthermore, the survey did not examine how LPS was being used by the different participants. It is possible that only some of the tools are being used within a project, instead of exercising a full implementation of the LPS. If this is the case, the SC participants may feel they have a good understanding of the system, when in reality they only understand some of the concepts. As a result, they may be satisfied that LPS is delivering benefit to their projects and remain unaware that there are further activities and resulting benefits that they could be making use of. Fernandez-Solis et al. (2010) identified partial application of the LPS system as one of the key barriers to successful implementation. This, combined with a lack of formal training, could explain the conflicting findings.

5. Conclusions

The New Zealand construction industry is currently experiencing an increase of work combined with a shortage of skilled labour. Inherent pressures to perform under these conditions has meant that it is more important now than ever to look at new and innovative methods of ensuring that work is being conducted to a high standard with as little construction waste as possible. This study has provided some answers and insights with regard to the barriers and facilitators to effective implementation of LPS in the commercial construction sector in Auckland, and indicated that experiences in the New Zealand situation are broadly in line with international research. One key difference appears to be the willingness of subcontractors to participate in LPS adoption. Internationally, subcontractors’ negative attitudes to LPS were a barrier to adoption, whereas the responses in this study found that subcontractors were often more positive than the main contractors.

Two main recommendations can be made in order to ensure that management tools such as LPS are effectively and seamlessly integrated into everyday projects within commercial construction in Auckland. The use of such management tools is mutually
beneficial to both main contractor and subcontractor workers in the long term, but without proper education and training, the system is likely to be implemented incorrectly and therefore ineffectively. Therefore, a greater emphasis on knowledge and education is needed, prior to implementing any new systems. One central question that needs to be resolved before this can be achieved is whose responsibility it is to provide this training. Main contractors are currently providing training for their own employees, but considering it is becoming increasingly common for main contractors to request LPS involvement from their subcontractors, it may be argued that the main contractor has a responsibility to train subcontractor workers to allow them to work effectively within this system. However, LPS is a skill that will be beneficial to subcontractors for future project use, so another perspective is that the responsibility should lie with the subcontractor to train their staff. Conversation between the two parties should focus on establishing the best way to deliver training to everyone involved, to ensure that projects get as much benefit from the tool as possible.

The second recommendation is focused around strengthening the collaborative relationships between main contractor and subcontractor workers. LPS requires the two groups to work together in order to effectively plan, programme and share knowledge surrounding task duration and requirements. The study has indicated that the two stakeholder groups appear to have skewed views of the other groups’ attitude. The main contractor participants feel that the subcontractor workers will not be willing to use tools such as LPS, while in fact the subcontractor group appears to have taken on board the idea of implementing new techniques. More participants in the subcontractor group felt that LPS has already made a difference on the projects they have been involved with, and all the participants involved in the study believed that LPS would make a positive impact on projects in the future. More open communication between the two stakeholder groups would ensure that the expectations regarding the use of such management tools are understood by all the parties involved in using them, as well as contributing to the formation of better collaborative relationships on site.

Research surrounding management tools such as LPS is limited in New Zealand, despite the fact that these are prevalent overseas and are becoming increasingly common in the New Zealand market. In order to ensure effective use, further research is necessary to identify the level of knowledge that participants have in regards to key aspects and their individual uses. Connected to this is the question of partial implementation. If projects are utilising only some of the tools and processes, then those involved may have the perception that they are successfully using LPS, while missing out on some of the potential benefits. A survey of current practice would allow any additional improvements to be identified.

6. References


Appendix A Sample questionnaire (LPS-specific questions)

For each statement below, please state to what degree you agree or disagree with the statement:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>disagree</th>
<th>agree</th>
<th>Strongly agree</th>
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</thead>
<tbody>
<tr>
<td>6. I am familiar with all aspects of the LPS tool</td>
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<tr>
<td>7. I am comfortable using all the tools in the LPS</td>
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<td>8. I feel like LPS has been used to its fullest potential on my projects</td>
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<tr>
<td>9. I feel that LPS could be implemented more effectively</td>
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<tr>
<td>10. When LPS is used on projects, I feel like everyone is committed to using it</td>
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<tr>
<td>11. LPS takes too much time to implement on site</td>
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<tr>
<td>12. I would be more willing to use LPS if I had more formal training surrounding it</td>
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<tr>
<td>13. By using tools like LPS, we are trying to fix something that isn't broken</td>
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<tr>
<td>14. Sites are already busy enough, there is no time for the additional administrative work required for LPS</td>
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<tr>
<td>15. I feel that using LPS has made a positive difference on projects that have used it</td>
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<tr>
<td>16. LPS will have a positive impact in the future if people are willing to implement it</td>
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For the remaining questions, please finish the statement:

17. I enjoy using LPS because:

18. The biggest fault with LPS is:

19. I would use LPS more if:

20. Any final comments regarding LPS?

‘Pacing’ Delays: The Essentials

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Abstract:
Concurrent delays have generally followed that where apportionment is not possible the contractor gets a time extension but no delay damages; in turn, the owner grants time extension and gives up liquidated damages. However, an exception to this can be found when either party tries to get rid from own liability asserting its concurrent delay is a result of a conscious decision for ‘pacing’, just to keep pace with the other party’s delay. Thus, the purpose of a ‘pacing’ delay is to claim compensation which may otherwise not be possible in a typical concurrent delay situation. Yet, the concept often involves in controversy as its success depends on the presence of certain essential circumstances. Without these essentials being factored into claims analysis, an arbitrary approach could potentially generate major disputes. However, currently there is only a limited amount of literature on the subject and the related case law is also scarce; this vacuum also appears to have contributed to the fact that contractors and employers often find themselves at odds over the ‘pacing’ delay claims. This paper aims to bridging this ‘gap’ to some extent through identifying essential pre-requisites for distinguishing, validating and quantifying ‘pacing’ delays. Here, ‘Case study’ and ‘Archival Analysis’ have been used as the research methodology while the ensuing discussion is based on related academic works and case law; it is believed that employers and contractors alike would be benefitted from the research findings to make informed decisions when dealing with ‘pacing’ delay situations.

Keywords: claims, compensation, delays, concurrency, pacing.

1 Introduction
Legally, at least under US jurisdiction, the right of a party to a construction contract to ‘pace’ its performance to another party’s critical path delay is acknowledged. Zack (1999) points out that as a legitimate business management decision the issue has been addressed by the courts, and it is clear that a contractor has a legal right to a “pacing” delay. A working definition suggested for ‘pacing’ delay is a “deceleration of the work of the project, by one of the parties to the contract, due to a delay to the end date of the project caused by the other party, so as to maintain steady progress with the revised overall project schedule” (Zack, 1999). Notwithstanding, the ‘pacing’ concept still remains a controversial issue in construction delay claims. Typically, ‘pacing delays’ occur in a period of concurrent delays; hence, the controversies normally inherent in concurrent delays may also be common to ‘pacing’ delays. Also, such controversies can be possible due to that the forensic application of pacing theory is often inconsistent with the actual performance of the parties at the time of the delay (Livengood and Peters, 2008). Further, there is only a limited amount of literature on ‘pacing’ delay and