LAST PLANNER SYSTEM PATH CLEARING APPROACH (LPS-PCA)

An approach to guide; clients, main contractors and subcontractors in the implementation of the LPS.

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ABSTRACT

The implementation of the Last Planner System (also known as Collaborative Planning in the UK) in managing production planning and control in the construction is growing. However, recent evidence from different parts of the world suggests that LPS elements are partially implemented and at other times the implementation is stalled. This is largely due to the dearth of a holistic approach to support construction stakeholders in the implementation of the LPS. In view of these the *Last Planner System Path Clearing Approach* was developed based on evidence gleaned from three years research, to guide construction stakeholders (client, main contractor and subcontractors) in the implementation of the LPS. The Last Planner System Path Clearing Approach (LPS-PCA) integrates organisational, project and external path clearing levels. This expands previous approaches to the implementation of the LPS in construction which focused more on the project level. A pilot implementation of LPS-PCA on a real world project with a client organisation indicates that the developed LPS-PCA supports the implementation of the LPS on a construction project.

CONTENTS

GLOSSARY OF TERMS IN THE "LAST PLANNER® PATH CLEARING APPROACH"

Last Planner System: is a production planning and control methodology developed by Ballard and Howell for the construction industry. It supports the development of collaborative relationship among construction stakeholders on a project.

Collaborative Planning: is a commonly used name for describing an application of production planning and control approach by practitioners in the UK construction industry.

Path Clearing Level: refers to the essential paths that need to be in place for the rapid and successful implementation of the LPS. They are three, namely; organisational level, project level and external enabler.

Organisational Level: It is one of the path clearing levels in the proposed approach. It identifies and defines what needs to be in place at the organisational level for LPS implementation. The organisational level factors also support the implementation of the LPS at the project level. It consists of the two input factors; the process input factor and the contextual input factor.

> **Process Input Factors:** this refers to the processes that need to be created and practiced at the path clearing levels in the implementation of LPS.
>
> **Contextual Inputs Factors**: this refers to behaviours that need to be in place both at the organisation and project levels that are capable of influencing the established process input factors positively. Its focus is to bring about social norm at these levels and to lubricate the process input factors in achieving the expected goals of the implementation.

Project Level: It is among the path clearing levels in the proposed approach. It identifies and defines what needs to be in place at the project level for LPS implementation. It also consists of the two input factors; the process input factors and the contextual input factors as described above.

External enablers: these factors operate outside the organisation and project levels. They are strategically positioned to support the implementation of the LPS.

1.0 INTRODUCTION

The implementation of the Last Planner System (LPS) is growing. The LPS is also known as Collaborative Planning (CP) in the UK. The Last Planner System implementation approach developed to guide clients, main contractors and subcontractors in the implementation of the LPS is known as "*Last Planner System Path Clearing Approach"* (LPS-PCA). The approach is based on an empirical study conducted in the UK, which spanned over a period of three year period. The approach consists of three major components. These include; organisational level path clearing, project path clearing and external enabler.

1.1 Why is LPS-PCA needed?

The positive effect of implementing the current practice of LPS is reduced due to the absence of an approach to support and guide construction stakeholders in the implementation process. The current practice of LPS in different parts of the world is largely stalled at some specific elements of the LPS. This has hindered the full realisation of the benefits from the implementation of the approach as intended. For instance, in the UK, the implementation of the LPS is stalled at collaborative programming or phase planning and there is lack of rigour in committing to the key elements of the LPS. In addition to this, there is a narrow view in the current application of the system. For instance, some construction stakeholders see the process as avenue to control the activities of other stakeholders in the project, rather than a platform for mutual communication and development of collaborative relationships. This implies that, resistance is subtly embedded within the current implemented practices. This shows the essential need for '*path clearing'*, so as to achieve rapid and successful implementation of the LPS.

1.2 What is the LPS-PCA?

It is an approach to guide construction stakeholders (clients, main contractors, and subcontractors) in developing an understanding of what needs to be in place for the successful implementation of LPS and also in sustaining its adoption.

1.3 What the proposed Approach is not

The proposed approach is not prescriptive; it is only a guide or roadmap to help in developing an understanding of what needs to be in place (Path Clearing) for the successful implementation of LPS in construction. This implies it is not rigid and could be adopted/adapted to various situations. Also, the proposed approach is not intended to provide a detailed description of the methodology for LPS implementation as this is available in various publications.

1.4 Why should I use it?

It will enable you to develop an understanding to make decisions as a client, main contractor or subcontractor on what is required for the successful implementation of LPS in both process and behaviour wise.

1.5 How should I use it?

The proposed approach as presented in Figures 1 and 2 on subsequent pages should be used alongside the guidance note provided for better and quicker understanding.

2.0 LAST PLANNER SYSTEM PATH CLEARING APPROACH

2.1 Block Diagram of LPS Path Clearing Approach

Figure 1 presents the basic diagram of the *"LPS Path Clearing Approach"* (LPS-PCA). The block diagram indicates how components in the proposed approach are closely integrated. For instance, Figure 1 shows that the organisational level feed into the pre-project activities, while the pre-project activities contribute to the implementation on the project. The external enabling factors on the other hand support all the operations as shown in Figure 1.

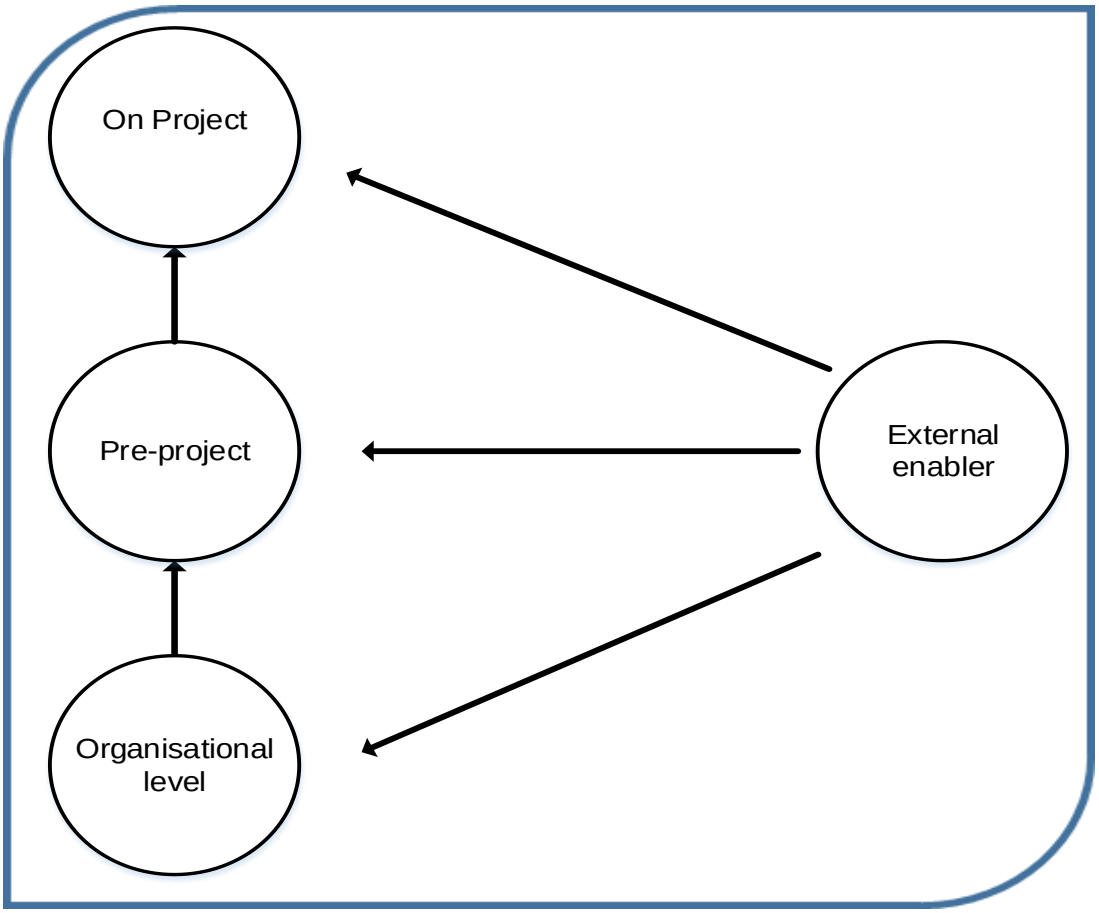

Figure 1: LPS Path Clearing Approach Block Diagram

This shows that each part requires some form of input from other components for effective functioning. It is worth noting that both pre-project and project components fall under the project level in the path clearing levels as will be described later in Figure 2. Figure 2 presents the schematic diagram of the LPS-PCA.

2.2 Schematic Diagram of LPS Path Clearing Approach

The schematic diagram of the proposed is presented in Figure 2.

Last Planner System Path Clearing Approach

The overall aim of the proposed approach is to guide construction stakeholders (client, main contractors, and subcontractors) in understanding what needs to be in place for the successful implementation of Last Planner System(LPS) and also in sustaining the implementation.

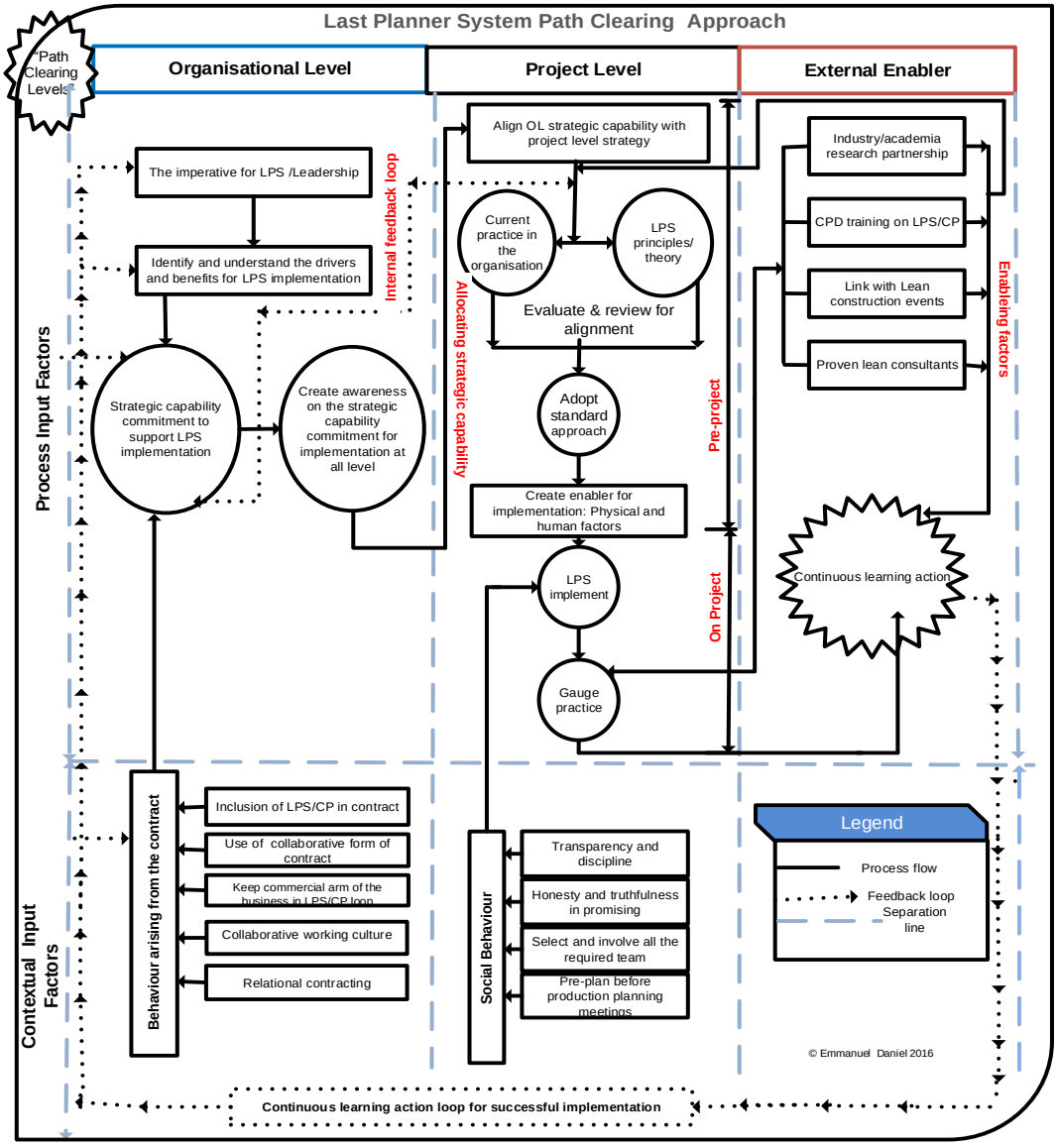

Figure 2: Last Planner System Path Clearing Approach

3.0 LPS-PCA GUIDANCE NOTE: STEPS FOR ACTIONS

The structure of the LPS-PCA and step by step description of its application is provided as follows:

3.1 Organisational Level

Organisations play a central role in the implementation of lean principles and techniques. The implementation of lean techniques has been hindered in the past because it was somewhat disconnected from the organisation's vision and the absence of a clear strategy. The organisational path clearing level consists of two input factors; the process input factors and the contextual input factors.

Organisational Process Input Factors: this refers to the processes that need to be created and practised at the organisation level in the implementation of LPS. As it is called, it defines the processes that need to be in place at the organisational level (OL) for LPS implementation . This includes;

- identifying the imperative for LPS implementation/ leadership
- identifying and understanding the drivers for LPS implementation
- Strategic capability commitment to support LPS implementation
- Creating awareness of the strategic capability created across the business.

Capital project clients and supply chain companies have an important role to play at this level. Commitment to this process input factors are essential for both the capital project client and the supply chain companies at this level. This is important because it has great influence in determining the success of the implementation at the project level. However, this cannot be achieved in isolation, thus, the OL input process factors are fed by the contextual input factors.

Contextual Inputs Factors*:* this refers to behaviours required at the OL that are capable of influencing the established process input factors. Its focus is to bring about social norm at the OL and lubricate the process input factors, especially the strategic capability commitment to support LPS implementation. At the OL, the contextual input factors are known as "behaviour arising from contract". This will be further explained under behaviour arising from the contract (see step action 4 on page7). This shows that the process input factor and the contextual input factors at the OL are interlinked.

3.1.1 Step Actions at the Organisational Level

Five key steps actions are required at the organisation path clearing level.

Step Action #1: The Imperative for LPS implementation and Leadership

The reason why an organisation chooses to use LPS must be clear. The reason should be beyond having a goal of fulfilling an expectation from the client. For instance, in the UK, the demand from the public sector client seems to be among the key factors driving some supply chain companies in the implementation of the LPS. Such drivers cannot sustain the implementation of the LPS, indeed it is a weak driver factor.

Ideally, the reason for LPS implementation should be based on the desire to become an active agent to support collaborative behaviour among employees. Thus, both the client and supply chain have roles in championing the implementation of LPS. This need should

be made explicit, to senior leadership so as to receive the required support is required for success.

In addition to this, a high level leadership support is required to drive the process. The expected leadership style is not just bottom-top or top-bottom, it is better described as 'empowered leadership' from within the team. It means each member of the team is empowered with the capacity to rise to the occasion when the need arises. Furthermore, the factors (drivers) that cause the imperative must be identified.

Step Action #2: Identify and Understand the Drivers and benefits for LPS Implementation

The drivers for LPS implementation in any organisation (contractor, designer subcontractor, client, etc.) are likely to vary.

This implies each organisation must identify its own drivers. The drivers for LPS in clients' organisations could include:

- quest to overcome past failures
- quest for time compression
- quest for better working relationship with supply chains
- benefits from previous implementation, and

While for supply chain companies, the drivers could include:

- Client and public sector demand, quest for timely completion
- internal desire for continuous improvement
- project complexity
- time certainty and efficient working
- avoidance of time overrun that could lead to liquidation and damages
- quest for improved communication with the team

The early identification of these drivers is an essential process input needed, as it has the capacity to encourage organisations (client and supply chain companies) to create the needed change that could support the implementation. Also, the benefits of LPS implementation should be explained to the organisation as it would drive the management to develop strategic capabilities to support the implementation.

Step Action #3: Strategic Capability commitment to Support LPS Implementation

Having identified the imperatives and drivers for LPS implementation, it is important to develop a clear strategy and capability to support the implementation. Without a clear strategy, the LPS implementation cannot be sustained in the organisation. Both the construction client and supply chain companies must create their own strategy. This should focus on explicit commitment to develop the required capability at the OL that would support the implementation. It includes a commitment to training and retraining of team to achieve the required competence, continuous development and coaching of the team.

Furthermore, the organisation's culture and appropriate policy should be aligned to support the strategy. Cultural issues (people) are among the most reported barriers to the

implementation of the LPS. This could be minimised through the development of the right strategy and policy to influence organisational culture. This strategy selection cannot be done in isolation. At this point, it is important that the supply chain companies and the construction client identify the specific strategy that best suit the implementation in their organisation. In a construction client organisation this may include:

- provision of internal training for staff(coaching)
- routine supply chain development programme
- standard supply chain assessment programme, and
- creation of lean business department

For supply chain companies it may include:

- start up and refresher workshops
- internal training of staffs
- training programme for subcontractors/trade partners, and
- lean academy for staff

Clear strategic capability commitment to support the LPS implementation significantly increases the likelihood of success. In doing this, clear contextual behaviours at the OL are required to support the strategy.

Step Action #4: Behaviour Arising from the Contract (Contractual term dictate behaviours)

Contractual behaviours are the appropriate behaviour that should be in place at the OL to support the strategic capability commitments for LPS implementation. It uses contract terms to encourage collaboration and commitment to the project goals and objectives. This helps in formalising the strategic capability identified, thus, it should form the key components of the strategic capability commitment process. These contractual behaviours include:

- the inclusion of LPS/CP in the contract
- using collaborative form of contract (framework agreement, Early contractor Involvement)
- relational contracting
- a collaborative working culture and
- keeping the business arm of the business in the LPS loop.

All of this applies to both construction client and the supply chain companies. It is worth noting that in most cases the choice of procurement route at the higher level is largely determined by the construction client, though there could be an exception. However, whenever the client chooses to use a traditional form of contract (e.g. Design, bid & build), the main contractor could still use other forms of collaborative approach such as going into framework with its subcontractor/trade partners and supply chains. Therefore, including the LPS in the contract should not be viewed as the client's responsibility only. The expectation is that the contract should be viewed as a relationship and support tools, rather than a mere transaction as seen in transaction economics. This is important as it has the potential of supporting the development of collaborative working culture.

People tend to work collaboratively when there is hope of future transaction. This is strongly supported in collaborative and relational form of contract. For example, a main contractor included the use of LPS in the contract with its subcontractor/trade partners and it supported collaborative working behaviour on the project. Irrespective of the procurement route employed, the LPS work best when the strategy for its use is clear and communicated appropriately. The essence of its inclusion in the contract is to encourage all the required stakeholders to get involved and benefit from the process.

Step Action #5: Create Awareness on the Strategic Capability Commitment for LPS

The strategic commitment capability for LPS implementation and the process created to formalise them at the OL must be communicated at all levels. This could entail the use of company intranet to communicate such an approach and information. The information guiding such an approach should be located in areas where it could be easily accessed. Also, workshops and trainings on the strategic capability commitment required should be organised at all levels. Specific avenues and approaches that could be used to create awareness on this include:

- company intranet, newsletters,
- workshops, trainings, and
- monthly project briefing among others

This would enable all the business departments to understand what the organisation is doing, which would influence their own individual commitment to the strategic capability identified at the OL.

3.2 Project Level

The project level (PL) factors are linked to the OL factors. The implication of this is that the strategic capability commitment for LPS implementation at the OL must be allocated appropriately at the PL. The PL is sub-divided into pre-project and project implementation activities as shown in Figure 2. Similar to the OL, the PL also consists of the process input factor and contextual input factor.

Project Process Input Factors: this refers to the processes that need to be created and practised at the project level in the implementation of LPS. It defines the processes that need to be in place at the project level (PL) for LPS. This includes:

- project level strategic capability commitment
- Identify and understand production planning practice in the project
- evaluate practice with LPS principle and theory
- adopt standard approach
- create enabler for implementation
- implement and gauge implementation

Project Level Contextual Inputs Factors*:* this refers to the behaviours that need to be in place at the PL that are capable of influencing the established process input factors. Its focus is to bring about social norm at the PL and lubricate the process input factors at the PL. These contextual factors are known as “social behaviours” at the PL. They include:

- transparency and discipline
- honesty and truthfulness in promising
- selection and involvement of all the required team
- pre-planning before production planning meetings

These factors would be described in the step actions in the PL.

3.2.1 Step Actions at the Project Level

The eight core step actions for LPS implementation at the project level are now discussed.

Step Action #1: Align and Allocate Strategic Capability Commitment from OL with the PL strategy

Developing strategy at the PL is essential; however, this should be aligned with the OL strategic capability commitment. This is important as the team on the project would be coming from different organisations. For example, an organisation can tell its employees that it wants them to embrace a process and educate them on why. However, projects could develop their own identity due to the vast array of companies required to deliver a project. In view of this, the project set-up; the companies involved, including client, contractor, suppliers and designer should establish a joint strategy that considers the unique characteristics of the project. This should be aligned with strategic capability commitments so as to avoid conflict. Also, the strategic capability commitment should be allocated and the strategy for actualising it should be made explicit to the team at the project level.

Step Action #2: Identify and Review Production Planning and Control Practice

At this point, it is essential for the production planning and control practice to be understood and streamlined to meet the strategic capability commitment and the strategy at the PL. To achieve this, the current production planning practice should be evaluated with an enhanced production planning and control principle such as the LPS principles.

Step Action #3: Evaluate and Review Practice Using the LPS Principles

The LPS is a production planning and control method developed for the construction industry and it is among the most used lean techniques in construction. Thus, the production planning and control practice of the project should be evaluated and reviewed for alignment with the advocated principles/theory of the LPS. The underlying theories of the LPS revolve around planning, execution, and control. The LPS is based on five principles which are to:

- ensure tasks are planned in increasing detail the closer the task execution approaches
- ensure tasks are planned with those who are to execute them
- identify the constraints on the planned task to be removed by the team beforehand
- ensure any promises made are secure and reliable, and
- continuously learn from failures that occur when executing tasks to prevent future reoccurrence.

Evaluating the practice based on the LPS principles would enable the identification of areas that needs improvement. The evaluation entails reviewing the practice with the six core components of the LPS (described in the next section). The evaluation should identify what is working well and the areas that need improvement. This is because what cannot be measured cannot be improved. A previous study by the authors shows that evaluation and review have high potential in revealing the level of alignment in the practice and identifying areas that need support/improvement.

Step Action #4: Adoption of a Standard Approach (Specific Capability Commitments Required)

Based on the evaluation and review in step action 3, a standard LPS approach should be adopted. The absence of such a typical approach could result into varied implementation of the process across projects, even in the same organisation. This means a project could be reinventing its own wheel every time, which could hinder the intended benefits from the system. It is worth noting that the standard approach is not rigid, thus it could be positioned to meet the reality of the project. However, since the LPS has five standard components, the team should therefore develop the specific capability commitments required for the implementation of the components on the project.

The five LPS standard core components are:

(1) milestone planning

(2) Phases planning or collaborative programming

(3) make-ready planning

(4) weekly work planning

(5) measurement and learning.

These components will be discussed briefly to gain understanding of the specific capability required for each component.

The master plan or milestone planning

The master plan or milestone planning captures the entire task to be executed throughout the project and at the same time shows the length of time required for each activity to be completed. It identifies the project milestones and initiates the means for achieving them. It forms the basis for the development of the collaborative programme or phase planning. It sets the promise of the project.

Collaborative programming or phase planning

Collaborative programming is a process used in developing a reliable construction programme from the master or contract programme by direct involvement of the subcontractors/trade partners, contractors, client, suppliers, designers and other stakeholders on the project. It is worth noting that this process is commonly called collaborative planning or programming by practitioners in the UK, while phase scheduling is the common name used for it in the Lean Construction Institute literature and in the US.

Make-ready Planning

The make-ready process is used to eradicate the constraints or blockers to planned activities identified in the look-ahead programme before they are passed into production on site through a constraints analysis process. Now, work needs to be considered in a greater detail as the make-ready process focuses on matching the available resources to work with the present realities of the construction site, so as to ensure production can proceed at an optimum level. The purpose of the make-ready process is to prepare for flow – all seven resource flows plus one soft flow need to be considered to enable the constraints to be removed and the resources and capacity balanced to enable successful production. The **"look-ahead planning"** is part of the "make-ready planning process. The look-ahead planning is a medium term plan for project activities and is developed from the collaborative programme considering the work to the next level of detail. Usually, tasks that will occur within four to six weeks in the look-ahead window are screened for constraints in all eight flows. These include the seven process flows; information, permissions, resources, space, material, previous work, worker, equipment and the plus one soft flow 'common understanding' However, in the traditional way of managing projects, the look-ahead plan (master programme) only provides advance notice of the start date of an activity and does not consider the complex network of flows, their sequence, matching work flow with capacity, or maintaining a backlog of workable activities.

Weekly Work Planning

A Weekly Work Planing (WWP) meeting is done to review the tasks planned in the previous week in order to plan for the week ahead collaboratively with the team. At this point, only tasks that meet the four criteria of production are entered onto the WWP. These criteria require that work must be

1. well defined (detailed task breakdown),

2. sound (can be done),

3. sequenced (interdependencies assessed) and

4. properly sized (load matches capacity).

Tasks meeting the four criteria, but not entered onto the WWP are held in readiness as a "workable backlog" or Plan B tasks. The workable backlog enables the workforce to drop onto these tasks if for any reason they are unable to complete work on the WWP. '*Daily huddle'* meetings are used to monitor how activities planned for the week are performing each day. Its focus is to guide the planned production from deviation and to re-plan when such is envisaged. It is also called daily stand-up meeting in the UK.

Measurement, learning and Action

The key metrics measured in the LPS implementation are; percent plan complete (PPC), the Reasons for Non-Completion (RNC) / Reasons for missed opportunities (RMC) and a developing Reliability Index using metrics from Tasks Made Ready (TMR) and Tasks Anticipated (TA). In practice, PPC measurement, and recording of RNC/RMC are the most commonly used. PPC measurement not only encourages learning, but also provides a clear indication of productivity. PPC is a percentage of the activities achieved against

those planned for the week. In measuring the PPC, the RNC is investigated for root causes using "5-Why", "Fish Bone Diagram" to identify common issues and to prevent recurrence. The PPC, the RNC and 5-WHY are usually reported using standard sheets, and they support learning.

Evaluation and learning within a lean construction system is tightly coupled with action. In this way, the production planning becomes agile and responsive to uncertainty and risk in problem solving, generating action in the moment – it is irresponsible to leave evaluation and learning until project closure. Doing this would support improved performance on projects.

Step Action #5: Create Enablers for LPS Implementation

For the adopted approach standard approach in step action four to work, implementation enabler must be created. Implementation enablers are the core factors required for LPS implementation on the project. The implementation enablers are grouped into two:

1. Physical factors enablers

2. Human factors enablers.

The physical factors entail the allocation of a designated room for production planning and control. This should include creating physical space such as co-location for working and visual production planning and control centre. Such location should be readily accessible to all the required stakeholders on the project, including the subcontractors/trade partners. It should also be located close to workstation to prevent non-value adding activities that could come from unnecessary movement. Furthermore, the board located in the room has the potential of communicating information visually to the team during and out of meeting time.

The human factor on the other hand is concerned with the appointment of a competent facilitators and lean champions to encourage the process on site. Prior research has shown that, facilitation is an essential process that needs to be in place for the successful implementation of the process at the project level. It includes both external and internal facilitation/coaches. External facilitation such as the use of proven LPS consultant/facilitator could be useful at the initial start. However, over reliance on external facilitator/consultant should be avoided. This is because it could make the team to view the process as an external initiative, thus reducing their commitment to the process.

Step Action #6: Social Behaviour

To successfully implement the LPS, the team needs to own LPS and see value from using it. Contextual input factors embedded as social behaviour is required at the project level. Social behaviours are those soft skills that need to be embedded in the project team for the successful implementation of the LPS at the PL. These factors include:

- transparency and discipline,
- honesty and truthfulness in promising,
- selection and involvement of all the required team,
- pre-planning before production planning, and
- proactive involvement of the construction manager.

In making promises in the LPS, the team is honest and realistic. Practically, it entails making promises that are realistic and achievable within the time frame. This suggests that no stakeholder in the project should be pressured into making undue commitment. The five rules for making reliable promise should be adhered to in LPS implementation. These are:

- Understand the condition for satisfaction (COS)
- Access competency before making promise
- Ensure capacity available and allocated
- Empower the team to say YES OR NO (sincerity)
- Accept responsibility for failure and re-review the process for learning

The action expected here is informed by social information exchange (conversation) as opposed to the technical information exchange that dominates the traditional project management. In such social conversations as advocated in the LPS, every stakeholder is empowered to make promises which could be YES! Or NO! Strong evidence exists, which shows that where such social network of conversation exists on a project, the LPS works in managing the production on site effectively. Also, reliable promising supports workflow and programme reliability, which is the core focus of the LPS. This shows the importance of social behaviour in the implementation of LPS at the project level. Furthermore, all the required team members should be involved in the process, including the subcontractors/trade partners. The proactive involvement of the lean leadership in production planning also increases the buy-in of other stakeholders on the project.

Step Action #7: Gauge Practice

As the implementation process continues, it is important that the practice is constantly gauged using both internal and external mechanisms. To gauge the practice internally, the Planning Best Practice (PBP) guide as presented in Table 1 should be used to access the level of implementation on the project. The PBP guide is developed based on extensive research on the application of LPS principles in construction. In addition, the LPS implementation maturity guide as shown in Table 2 should be used. The guide was originally developed by Gregory Howell, who created LPS with Glenn Ballard. Through this, the efficacy of implementation could easily be assessed internally and areas that need improvement could be identified and addressed appropriately. The gauging of the practice also requires input from the external enabling factors.

The PBP based on previous studies on the implementation of the LPS in construction. The PBP has been used to assess the implementation of the LPS in different parts of the world such as Brazil, Israel Chile, and UK among others. The PBP practices are presented in Table 1.

Table 1 Production planning and control practice (Planning Best Practice)

		Level of implementation			
	LPS Practice	**F**	**P**	**N**	**Level of implementation in percentage (%)**
1	Initial collaborative programming/phase planning meeting				
2	Formalisation of Weekly Work Plan (WWP)				
3	Measurement of Percentage Plan Completed (PPC)				
4	Planning and control process standardisation				
5	Involvement of subcontractors/trade partners in planning and decision process				
6	Formalised shared decision making process				
7	Lookahead Planning				
8	Detail specification of task				
9	Recording reasons for non-completion of task				
10	Formal system to take action on reasons for non-completion of task or reasons for missed commitment(RMC)				
11	Analysis of the eight flows				
12	Make ready planning and analysis of constraints and constraints log				
13	Use of prototyping/First Run Studies				
14	Constant evaluation and learning				
15	Formal communication of result to supply chain using visual device				
16	Detail consideration for flow				

17	Programming workable backlog				

Key:

F= full implementation

P= partial implementation

N= no evidence of implementation

Weighting:

F= 1.0

P= 0.5

N= 0.0

Using the information provided above, the level of implementation on projects can be ascertained over a period of time.

Step Action #8: Gauging LPS implementation with implementation assessment question

Table 2 presents standard questions used in assessing the implementation of LPS on projects developed by Lean Project Consulting. The repeated assessment of LPS implementation based on these questions supports learning and improvement in the implementation process.

Table 2: LPS implementation, assessment questions

	LPS implementation, assessment questions	**Yes**	**NO**
1	Are key milestones and budget established and shared with the team?		
2	Have those targets been reviewed with the team within the last 30 days?		
3	Is the team confident the targets can be met?		
4	Was a pull plan produced for the current phase within the last 120 days?		
5	Has a pull plan been developed for any phase that is anticipated to start within the next 45 days?		
6	Was the pull plan (phase planning) developed by designers, client representatives, consultants, specialist contractors and the contractor working together?		
7	If there were key players missing, were they invited?		
7b	If no above, did the team cope with their absence effectively?		
8	Is the status of the phase plan discussed in the project leadership meeting?		
9	Are the team confident the work on pull plan can be completed within the current milestone?		

10	Is the project being managed with a 6-week look-ahead plan (LAP) in the make work ready plan?		
11	Are constraints identified and promises secured to remove them?		
12	Is the project coordinated using the LAP at the site level?		
13	Are performers raising constraints throughout the six week interval in the work make ready plan?		
14	Are constraints identified on the LAP and are they discussed in the production planning meeting?		
15	Does the team promise to remove constraints for which they are responsible?		
16	Are the team confident the work on that make the work ready plan can be started and completed as shown?		
17	Are all tasks shown to be constraint-free on the LAP really ready for work -- lacking only the application of labour and prerequisite tasks?		
18	Has workable backlog been established for each performing group?		
19	Are design teams and crews using a weekly work plan (WWP)?		
20	Is only ready work promised?		
21	Are daily completions identified and accepted as promises kept?		
22	Are daily stand-up meetings held for managing promises?		
23	Are completions reported publicly on a daily basis?		
24	Are the completions recorded daily along with the reasons for non-completion?		
25	Is PPC charted and on an improving trend?		
26	Are reasons for failure accumulated on a Pareto chart?		
27	Are reasons for failure discussed regularly by the team and the ideas developed to improve performance – eliminating the underlying causes?		
28	Has an assignment been rejected because it wasn't ready?		
29	Does the project team have a mood of ambition and determination?		
30	Are performers adjusting their actions during the week to help others?		

***Source**: Lean Project Consulting, 2005*

3.3 External Enabler

The external enablers do not just gauge the practice, they also introduce in new strategies and innovations to improve the current practice both at the PL and OL as shown in Figure 2. Unlike the OL and PL, external enablers have only the process input factors embedded as external enabling factors. These include:

- research partnership between the industry and the academia,
- CPD training courses on LPS
- engagement with proven LCI accredited Last Planner Consultant
- Lean Construction Institute events

Step Action#1: Engage with the external enabling factors

There is need to deliberately engage with the external enabling factors presented here. This is primarily because it has been observed that the LPS is dynamic and it always uses various avenues to improve practice, for example, its use of theory to explain practice. External forum and partnership could be an avenue for communicating and learning about such improvement or findings. Academic action research partnership with the industry and facilitation of the process supports the implementation of the LPS. For instance, external facilitation from proven LPS coaches are critical to starting, setting out and sustaining the loop.

Step Action #2: Continuous Learning Action and Feedback Loop

A continuous learning action is the loop that sustains the implementation of the LPS. It focuses on learning and taking action at each level. The continuous action learning advocated occurs at every point in the process as shown in Figure 2. This implies that learning occurs throughout the process. As shown in Figure 2, there is an internal feedback look between the OL and PL; this is done to ensure refinement issues are attended to before the process is rolled out completely. For instance, with the roll out of strategies, unintended consequences may occur. It is helpful to understand these sooner than later which emphasises the importance of creating internal feedback loop. In the implementation of the LPS bad news early at the LPS wall is better than recovering bad news in the field weeks or months later. Alternative options can be discussed and completed by the team.

Also, there is an in-built feedback loop at the project level to assess the implementation to enable appropriate actions. These include the Planning Best Practice and the 30 LPS structured questions. These instruments have the potential of revealing areas that needs improvement while the process is still on-going.

Furthermore, all the learning actions feedback into the entire system to further support the internal feedback loops. For effective learning, action data should be captured, investigated for root cause(s) and a formal strategy should be developed to act on them to support continuous learning. New ideas and innovations emerging from the implementation process should feedback into the system for better improvement.

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