CHAPTER III

LITERATURE REVIEW

Womack et al. (1990) presented the concept of lean manufacturing. He stated that lean principle main aim is minimizing construction wastes and improving quality and efficiency in the construction industry. The lean waste incorporates all types of overproduction, over-handling, delay, abundance stock and movements, failure, and imperfections. He concluded that the process variability, frequent and prolonged equipment breakdowns, changes in design and shortage of material give rise to process waste in construction.

Koskela (1992) stated that in Lean manufacturing; a significant gain in project performance is by another generation reasoning, which is known as "lean creation." The regular issues of development are notable: low efficiency, poor safety, second rate working conditions, and inadequate quality. He introduced the concept of lean production philosophy which is relatively a new approach and stated that it could also be viewed as a tool like a Kanban, quality circles, JIT method and a general management philosophy like lean production. He concluded that by implementing the lean principles, techniques of new production philosophy are improved and reduced the defect rates and time.

Womack and Jones (1996) identified flow as a continuous value-added process where once a task starts, and it continues till it gets completed. In lean principle, the entire process observes holistically, and the dependency within the process results in eliminating delays, defects, rework, errors and all forms of wasteful activities or materials.

Ballard and Howell (1998) defined the low levels of workflow reliability on development projects, resulting from inadequate planning and manifesting in high levels of unproductive time. He revealed an ineffective level of plan, resource assignments, involving labor, tools, equipment and reported that contractors complete less than 60% of weekly work task and 30% of employment required when planning reliability reaches levels higher than 50%. To improve development planning and avoid unreliable workflow,
the study advocates protecting activities from variability in upstream flow; establishing right buffers to cater for the remaining variability; and exercising commitment planning. Consequently, Ballard and Howell concluded that implementing the Last Planner System as a production planning and control system will increase the workflow in construction projects.

**Koskela and Howell (2000)** explored the theoretical foundation of Lean construction. The foundation is divided into a theory of project and a theory of management. He revealed that Lean construction method is evaluated through feasibility study, practical validity, consistency and competitive theory. He added value-collective support to the success of the last planner in view of a better basis for traditional project management and construction project management.

**Koskela (2000)** defined the relationship between flow variability and task realization in lean manufacturing. Considering a 5% uncertainty in the seven flows that are prerequisites to construction task, results in a 70% chance of having that task realized and the effects of decreasing variability on labor flows to improve construction performance yet end up focusing more on increasing labor use than the value added to the construction work.

**Randolph Thomas et al. (2002)** tried to test the connection amongst changeability and execution of work to edify the development supervisors and analysts on which lean development process activity is probably going to impact project execution. Customary administration thinking like lean generation recommended that diminishing yield changeability can accomplish gifted work and project cost execution. Numerous endeavors are taken to utilize lean reasoning procedure in development, up until now, have created constrained evidence to help this claim. Utilizing profitability information from solid, platforms, covering exercises on different project s, and different measures of yield changeability are tried against development project execution. It demonstrates that the changeability in yield is inaccessible, and there is a little connection between yield fluctuation and development project execution, yet inconstancy in talented work profitability is identified with development project execution. He inferred that the lean development process activities diverted to new workforce administration abilities to
diminish changeability in labor efficiency rather than yield to enhance the development project execution.

**Javier Freire and Luis Alarco (2002)** recognized the issues of outline of compositional/building development offices, administration issues and the impact of configuration arrange on the result of development project s both in fact and financially. The strategies utilized in this examination are Conceptualizing, Value age show, Performance pointers and Time dispersion process. The system for the situation considers took after is Evaluation, Changes Implementation, Control, and Standardization. The yield from this exploration prompts increment in 31% in the offer of significant worth included exercises, 44% decrease of unit mistakes in the creation, up to 58% reduction of holding up times in the advance and an extension of the use in the process durations.

**Michael L. George (2002)** studied the usage of the lean philosophy with six sigmas is supplementary. According to the researcher, the lean opinion will help the processes to speed six-sigma, and on the other hand, it will not only bring operations under statistical control but also it will give quality in the construction project. Through analysis, he found that the academic studies about six-sigma are abundant, especially in the business administration, mechanical and industrial engineering disciplines. He concluded that six-sigma provides a highly prescriptive cultural infrastructure useful in obtaining sustainable results and cut the defects within the construction project.

**Mario Fiallo et al. (2002)** expressed that the contextual investigation concentrated on the use of lean development apparatus Last Planner to the customary administration frameworks of the development business. Lean development is another logic situated towards improvement generation association and gets profitable streams with way to develop control backgrounds with the point of decreasing troubles all by the process. One of these administrative limitations is Ballard & Howell. This strategy presents the fundamental changes executed in arranging and control. LPS likewise incorporates fabricating unit, work process control, and quality task. It opens based on issues, affirms the suitable decisions to make the vital changes in the work, to complete the exercises and increment proficiency.
Ballard et al. (2003) presented the stream view inserted in lean creation is interpreted in the TFV (Transformation-stream esteem age hypothesis). Be that as it may, TFV hypothesis fuses three suppositions of creation: change, stream, and esteem. The stream sees pushed by TFV centers around diminishing and dispensing with squanders and other non-esteeem including exercises from the esteem stream. He inferred that TFV hypothesis would help in lessening the lead times, decreasing changeability and improving procedures. Additionally, TFV hypothesis pulls generation control and consistent process improvement.

Womack and Jones (2003) defined lean endeavors as an organization that endeavors to expand an incentive for clients, arrange the esteem adding projects to stream easily, streamline movement stream as indicated by pull from the client and seek after flawlessness through a perpetual ad project of consistent change. He concluded lean concept as a progress in the development industry exercised with applying lean methodology to increase construction process, educating experts, and performing investigation to assess current issues and suggest advancements.

Ballard and Howell (2004) expressed that the production arranging and control framework in the LPS effectively actualized on development projects to expand the arranging, increment creation execution, and enhance work process in plan and development tasks.

Albert Agbulos et al. (2006) concentrated on to create enhanced work strategies and designed profitability gauges for the different waste tasks. The techniques proposed by this paper are work disentanglement strategy and work estimation idea. The methodology to analyze is a simulation model. He concluded that the selection of this lean hypothesis prompted 4% of change of its productivity in his case study.

Ossama M. Salem et al. (2006) compared at the systems produced for lean development with those intended for lean assembling. The general and illustrations affirmed quality guidelines, and quality confirmation with the joint exertion of the improvement organization and the proprietor to fulfill security necessities, ecological concerns, and concurrence with material principles. They concluded that the benefits of implementation
were tangible: the project was under budget and four weeks ahead of schedule, and subcontractors were more satisfied with their relationships with the leading contractor and the average planned percent complete was 79%.

Chul-woo Lim et al. (2006) investigated the instances of planned percent completion (PPC) and its use in other countries and compared it with the production control system in Korea’s construction industry. In Korea’s construction firm, however, the concept of planned percent completion is still relatively new. The LPS consists of four steps: Principal Schedule, Phase Plan, look ahead Scheduling, & Weekly Effort Strategy. They concluded that the use of PPC in Korea’s construction industry was beneficial and it also identified the assignments that require continuous improvement.

Sacks et al. (2007) planned a lean model for the building administration of elevated structure with a tweaked auxiliary outline. Numerous progressions were done to conventional undertaking administration work on, incorporating work process with pull planning, work rebuilding assignment. A reproduced development process novel conceived for starter appraisal of the model. At first, reproduction actualized in a live administration amusement, where members assumed the basic parts of the proprietor, customers, nearby contractual worker, and different subcontractors. The PC reproduction upheld the discoveries of the live recreation and the useful effect of single-piece work process under force arranging and planning. The lean model is of quick enthusiasm to last organizers and undertaking directors since it empowers full customization with less waste and no different assets. They presumed that lean model reproduction, both mechanized and live, results in a great instrument for instruction and research.

Ballard et al. (2007) stated that fluctuation undermines project execution, creation frameworks intended to oversee vulnerability and changeability. A basic instrument for overseeing generation frameworks in development is the LPS which have been effectively executed on development activities to expand the arranging, enhance generation execution, and help in making an anticipated work process. In this way he presumed that the unwavering quality depicts the plans executed by contrasting arranged work with genuine work achieved.
Hopp and Spearman (2008) expressed two kinds of changeability in an assembling generation setting: (1) progression time for an errand implemented at a workplace and (2) the amount of project landing in a workstation. The mission to lessen the negative effects of changeability and increment the unwavering quality of work process has prompted the improvement of the LPS for creation arranging and manages. This technique has been effectively actualized on development undertakings to expand the dependability of plan, enhance generation execution, and make an anticipated work process.

Liu and Ballard (2009) shown how the utilization of the LPS strategy could increment both the Planned Percent Complete and profitability too and to make a more solid week after week work design.

Farook Hamzeh et al. (2009) suggested that the LPS has been successfully executed in construction assignments to enhance the variability, consistency of arrangement & scheduling, improving project performance, & creating a systematic workflow. However, some engineers questioned how to use the Last planner system during design & execution process. A collaborative planning practice used on the task gets inspected, coordinated, examined & reported.

The discoveries from examination revealed that the Last Planner structure nuts and bolts speak to both deliberative and action models. From one point of view, deliberative masterminding occurs at the ace timetable and stage plan dimension of the task. Then again, an orderly arrangement is done at the look-ahead arrangement, where creation structures consider changes in nature and the variable affecting information sources, methodology, and yields of plan exercises. He concluded that the structural designer and site engineers turned out to be more agreeable in arranging their week by week work design and using the force sessions and preparing on Last organizer framework added to quick organization of the planning procedure.

Koskela et al. (2010) studied the Critical Chain Construction Management with the LPS inside the setting of development management. The creators condense that while Critical Chain tries to abbreviate the undertaking span with cost decreases (where different advantages are auxiliary) the Last Planner principally attempts to cut the changeability in
work processes, which straightforwardly prompts expanded efficiency and cost decrease alongside picks up in safety & brilliance.

They concluded that Last Planner assists with plan pressure as it lessens inconstancy and there is a little degree for efficiency change through changeability decrease. In correlation, the Last Planner neglects to help an unequivocal connection with the ground-breaking strategy and the present circumstance on location can't be promptly surveyed from a general project point of view.

**Seppanen et al. (2010)** expressed that Look-ahead arranging is a parameter of the Last Planner System (LPS), which could be utilized to set achievable developments on the arranging course of events. The critical phase of turning points, going about as due dates, would then be able to be utilized as the benchmark from which invert stage planning is performed where exercises appropriated as needs be, and the creation rate of every occasion is balanced inside feasible limit to meet the forced require to time.

**Randolph Thomas et al. (2010)** stated that variability in yield is inescapable and there's next to no relationship between yield changeability and project execution, anyway that fluctuation efficiency is entirely correlative to extend execution. The examination researches the association amongst changeability and project execution to check the idea that decreasing yield fluctuation can prompt enhanced work execution. New administration considering, like that of lean generation, has expanded work and esteem execution by bringing down output changeability.

Lean thinking on development variability is available to clear up the applicable standards and improvements in this space. The focal point of lean generation is on advance yield the stream of work through a strategy or framework and flexible capacity strategies to deal with the troubles made by creation changeability. The creator presumed that the best parametric measurement was zero and the low connection between advance inconstancy and execution recommends that diminishing advancement fluctuation would have the littlest effect on execution.
Wambeke et al. (2011) performed a worldwide survey that distinguished the most common causes and sizes of variety by the impression of art laborers, foremen, and undertaking directors. Their examination additionally quantitatively investigated the hidden structure of the reasons for change utilizing factor examination. They reasoned that factor examination was utilized to create different variables that concentrated on the arranging procedure by the number of exchanges included.

Farook Hamzeh et al. (2011) aimed to enhance look-ahead arranging practices in the development to enhance the creation arranging. They tried to evaluate the look-ahead arranging, exhortation to take after an institutionalized strategy in structure to help a high linkage between look-ahead arranging & movement execution & increment the creation arranging. This investigation utilizes contextual analysis examination, project interviews, and a site review to survey the present routine with regards to look-ahead anticipating development extends in North America, South America, & Europe. The contextual analysis discoveries uncover the resistance with Last Planner System rules, deficient look-ahead arranging and institutionalized practices, inert recognizable proof, and expulsion of imperatives and nonappearance of examination for project design failures.

A. Nieto-Morote and F. Ruz-Vila (2012) explicit that the most distinction between the Last Planner production system developed by Ballard and classical management systems is that the means within which construction projects are controlled and planned. The Last Planner system focuses on dominant production units, workflows, and the quality of the performed work. It conjointly permits the identification of the causes for the non-completion of planned work and decision-making in accordance with the project necessities so that actions are timely, and productivity is enhanced.

The objective of this analysis is to present the results obtained from implementing the Last Planner system within the construction department of a chemical company. During this department, an information flow problem was detected among its members, during which supervisors lacked information regarding the work to be performed till the project had been perfectly designed. This problem usually led to long delays within the projects. The results from the Last Planner system implementation show that distinguishing the constraints of
the planned work results in an improvement in the percentage and quality of completed activities.

Mohd Arif Marhani et al. (2012) discussed the approach of Lean Building near augmenting supportable building in Malaysia. He stated that lean construction minimizes waste, improving productivity and safety of all the employees within the construction business. This research gave major learning of the generation of lean. Since the standards of lean development are broadly actualized, comprehension of the organization's comprehension of the issue will be comprehended. By utilizing lean assembling methods, the assembling business has improved and manageability.

Al-Aomar Raid (2012) distinguished the sorts of waste and their present presence in the assembling and examined the causes and effects of these squanders. The strategies utilized in the examination are JIT, 5S, SOP's, Quality at source cross preparing, visual guides, cooperation. The procedure pursued is a Six Sigma rating (Data-driven quality improvement strategy). The study identified the types of wastes and categorized into commonly used seven types of wastes in lean production.

Vishal Porwal et al. (2012) expressed that fluctuation and vulnerability are the two chief terms utilized in development venture generation and distinguished as a zone of a way to deal with progress. Contextual analysis is done on a 17-storey private structure venture in Mumbai, India. The outcomes demonstrated that the creation plans arranged by the development group were not enough as it experienced numerous changes, yet later improvement seen at the last phase of the venture. Percent Plan Complete, (PPC) differed from 23% to 99% over a time of 24 weeks. The noteworthy purposes behind disappointment for creation plan were atmosphere conditions, inaccessibility of works, inaccessibility of materials, not giving illustrations on schedule and pending choices, city principles and guidelines, government consistency and occasions.

Abhijeet Deshpande et al. (2012) focused on implementation of Lean techniques to design and identifying its scope. The method pursued is settling on choices finally capable minute and 5S system. The paper concluded based on identification of Last planner system.
efficiently used to transparently trace the process of conversion of input into design of the facility.

Jose L. Fernandez-Solis et al. (2013) expressed that the numbers of construction project managers initializing the utilization of the Last Planner System of Production management (LPS), a software system for project management designed to optimize advancements and promote speedy learning, is apace increasing, actuated by trade trends and testimonials of its perceived advantages. This study, restricted to the construction sector, is systematic literature and testimonial search of the perceived motivations and advantages or challenges for selecting LPS.

It substantiates the claims of these perceptions through a structured survey of senior and mid-level managers. Quantitative applied mathematics infer that practitioners whose LPS expertise additional reliable planning, better supply chain integration, and fewer advancement time. However, managers who directly implement LPS are visage with external resistance from owner and sub-contractors and feel that their organization doesn’t provide the required incentives for adopting LPS, indicating a doable clash of paradigms.

Algan Tezel and Yasemin Nielsen (2013) expressed that Lean construction is that the term that corresponds to the reflection of the assembly system developed at the Toyota Corporation on the development industry. Turkish contractors represent an outsized portion of the native economy and are vital international actors within the contracting business. Lean construction-based analysis and follow, as a production management-based approach for increasing the effectiveness and potency of the development trade, are scarce among Turkish contractors.

This analysis presents the results of a survey ready to predict the lean conformity levels of Turkish contractors and discusses the results. The comparative strengths and weaknesses of Turkish contractors for a lean construction initiative are highlighted. The findings that are conferred during this analysis can be used as a starting point to disseminate the investigation and follow in lean construction among Turkish contractors within the future. An identical reasonably analysis is continual to match the lean conformity levels in
numerous countries and to gauge the lean construction programs at different firms after the introduction of lean construction.

**Remon et al. (2013)** suggested that lean development objective was to expand the execution at the task level, outline, development, and the utilization of undertaking control all through the life expectancy of the project from origination to the execution procedure. He inferred that the LPS is a useful strategy of lean development and approaches and is more typical and demonstrated that it could improve the development project administration framework in different perspectives. Additionally, he proposed to build up a method for procedure calculation and discover the territories for improvement considering lean approach standards and the last organizer framework results indicated change in design dependability.

**Ograbe Ahiakwo et al. (2013)** aim was to carry out Lean Construction (LC) technique in Nigeria to improve the workflow. The design science research method is used with various data collection methods. These methods included direct and indirect observations, interviews with the construction team, preparation of questionnaires & finally documentary analysis. The research study is carried out in a construction site at university in Nigeria, where four hostel buildings construction work was under progress by four different local contractors.

The results disclosed that the Lean construction project made tremendous improvements regarding the completion time of the project, 30% of cost savings as against the others and an average Percentage Plan Completed (PPC) of 80%. Therefore, the researcher concluded that the Last planner system technique identified the constraints involved in the project and it also decreased the consequence on the construction development associated to the other three projects.

**Ojo et al. (2014)** stated that by implementing the lean concept in construction conducted for motivating the research scholars and practitioners. He demonstrated the instructional class objectives and substance, and additionally the standards, apparatuses, strategies, and practices of Lean Construction rationality. Specialized addresses led, workshops composed, and reenactments made, just as the input taken from understudies. They
concluded that the accomplishment of the instructional class is mirroring the open opportunities for development distinguished amongst altering and distributing the exploration, made conceivable through the criticism gathered from members.

**Raghavan et al. (2014)** proposed actualizing the lean ideas on Indian Construction Sites. The construction industry in India has been on a quick development path of lately and expanding proficiency and productivity has been a basic concern. IIT Madras, a technical institution, had recently taken up a program as a challenge to implement the Lean construction process in some of the projects through a webinar based training course, reporting in technical formats, site visits and carrying out reviews regularly. Building destinations urged to embrace the Last Planner System strategy and to utilize other Lean apparatuses top to bottom assistance from the workforce. They concluded that by implementing the lean practices in Indian construction projects; will minimize the project duration and will improve the project planning & setting up.

**Patricia Tzortzopoulos Fazenda and Lauri Koskela (2014)** aimed is to gauge the effectiveness of implementing the Last Planner System (LPS) to enhance project planning practice and enhance site management within the Saudi industry. LPS was enforced in 2 massive state-owned construction projects through an action analysis method. The information assortment ways enclosed interviews, observations and a questionnaire survey. The findings determine advantages as well as improved construction planning, increased site management and higher communication and coordination between the parties concerned. They conjointly represented the important success factors for LPS implementation and barriers to the belief of the complete potential of LPS, together with the involvement of the many sub-contractors and people's commitment and perspective to time.

**Soren Lindhard and Soren Wandahl (2014)** explicit construction sites are dominated by chaos and quality, implementing difficult conditions for establishing reliable and sturdy schedules that are simple to look at. The various large numbers of delayed activities that once more ends up in an unreliable schedule. LPS was introduced as a production coming up with and system to extend the reliability of the planning task. By focusing on the
removal of constraints, the LPS has successfully reduced the quantity of delayed activities. To additional decrease delays, this analysis investigates the causes of delays at 3 construction cases. In total, 5424 planned activities were followed, whereof 1450 were delayed. The delayed activities were, besides the unidentified ones, classified into eleven totally different categories and a statistical test of means was performed.

The analysis unacconcealed 6 often-occurring causes to delay: connecting work, modification in work plans, workforce, external conditions, material, and construction style. Moreover, the study disclosed five seldom-occurring causes to delay: material, tools and plants, prerequisites, weather conditions, and safety. The findings are structured in accordance with the preconditions employed in the LPS theory. Therefore, the results will directly be applied to the making-ready method and used as steerage of wherever to intervene to minimize future delay.

Chien-Ho Ko and Neng-Fu Chung (2014) expressed that Improper design within the construction industry leads to modification orders, rework, reduced constructability, value overruns, and delays, creating it one amongst the largest causes of waste. They aim to develop a lean construction process to enhance design reliability by creating a learning environment using the design correctness ratio. Waste is first known by analyzing the planning process. A new design workflow is then proposed using lean concepts to smooth design work, reduce unnecessary design errors, and increased design reliability.

They concluded that the proposed process can provide team members with feedback on design status, and thus allow for continuous improvement. The lean method is conceptualized using system dynamics to validate pertinence. The analysis shows that the proposed lean design process can enhance design completeness and reliability, thus increasing design correctness. Waste because of improper design can be reduced consequently. The projected method is one amongst the primary to use the lean approach to construction-project style.

Farook R. Hamzeh et al. (2015) stated lookahead planning is to plan more realistic as construction tasks move closer to execution. To improve the reliability of lookahead planning, the construction industry benefited from implementing the Last Planner System
(LPS) which emphasizes improved workflow during construction. Lookahead coming up with involves reworking work that 'should be done' into work that 'can be done'. This is accomplished by breaking down activities into the extent of operations, designing operations, and making tasks ready by removing task constraints.

The purpose of this analysis is to review, through computer simulation, the relationship between improving tasks made ready (TMR) in lookahead planning and the reliability of weekly work planning expressed as percent plan complete (PPC) and their impact on project period. Results show that a high TMR can result in a reduced project duration but the same cannot be said about PPC, making a case for TMR serving as a better indicator for project duration than PPC.

Ha Duy Khanh and Soo Yong Kim (2015) discussed that production planning has a critical role in obtaining project success through improving the reliability of workflow. Previous studies have shown the effectiveness of production designing in construction projects. This study aims to examine the current practice of the production planning system in Vietnam Construction Industry (VCI) based on the Last Planner System (LPS). An assessment framework for production planning procedures has been employed according to previous studies.

A questionnaire survey, case study, and expert survey were employed in this study. The results of the analysis have indicated that most of production planning procedures at team workshop step and weekly work plan step in VCI are well performed; whereas most of the procedures at lookahead plan step are superficially performed. Master schedule and weekly work arrange are the foremost used plans when executing a building project. Tool for constraints analysis and power for mensuration of percent plan completed are extremely used.

'Low understanding of the ideas of LPS' and 'language and culture issues' are the most important and smallest barriers severally. 'Indirect cost savings' is the most beneficial factor if the present barriers are removed. This study then proposed some relevant solutions to enhance the performance of production planning processes in VCI.
**Vitaliy Priven and Rafael Sacks, (2016)** discussed that the empirical evidence of the effects of the Last Planner System (LPS), the mechanisms by that it works are less well understood. It's strengthening of the social networks at intervals construction comes implies the chance of enhancing collaboration using means other than or in additionally to the LPS. Inspired by Rousseau's Social Contract, a new management artefact called the Social Subcontract (SSub) was devised to test this hypothesis.

The results provide anecdotal evidence that application of SSub together with LPS improves coordination and workflow more than the application of LPS alone. SSub also appears to motivate the general contractor to perform the make-ready process, which otherwise is often not implemented. The research provides a new understanding of how the LPS functions. It contributes to trade and academe by relating theory to follow, probably strengthening the boldness with that practitioners will apply such interventions to enhance production flows.

**John A. Gambatese et al. (2017)** describes a research study of lean and safety principles and practices with regards to worker behaviour and safety practices. Specifically, the study aimed to research the extent of alignment between lean construction principles/practices and employee behaviours related to construction safety. To conduct the study, the researchers used a multistep method involving a comprehensive literature review, document content analyses by an expert panel, and a survey of industry practitioners knowledgeable about lean construction. The findings support the perspective that several similarities exist between the appliance and impacts of lean and safety principles and practices.

Lean practitioners surveyed believe that implementation of the last planner system as a lean practice is most beneficial to the following safety practices: management commitment, pre-project planning, and pre-task planning. The present study revealed that lean principles and practices can provide a valuable opportunity to further improve construction worker safety; however, the findings show that there is a difference between lean construction and safety management practices, revealing a gap with respect to employee behaviour.
Emmanuel Itodo Daniel et al. (2017) expressed that the aim of this research is to find how the newly emerging UK practice of "Collaborative Planning" (CP) for construction project delivery aligns with the advocated principles of the Last Planner System (LPS) of production planning and control. A mixed, qualitative, exploratory approach was adopted for the study. This entailed qualitative data gathered through 3 methods, namely: semi-structured interviews, document analysis, and structured observation. Thirty in-depth interviews were conducted over a 12-month period with lean construction consultants, clients, main contractors, and subcontractors drawn from the building, highways and infrastructure and rail sector. Fifteen projects were visited where practices were observed. The study reveals that the present practice of CP within the UK partially aligns with the LPS principles. Where practitioners have heard of the LPS they believe it to be the same practice as CP.

Tito Castillo et al. (2018) expressed that the management practices of lean production within the last planner system (LPS) have enabled significant improvements in project performance worldwide. These improvements are, in part, attributed to practices that strengthen social networks within projects and enhance effective communication. However, the relationships by that LPS management practices and structure characteristics impact project performance aren’t standard and need in-depth investigation. To achieve a better understanding of these relationships, analysed data was collected from nine construction projects from two Chilean construction companies.

Correlation analysis was applied to the degree of implementation of LPS practices, social networks metrics, and key performance indicators (KPIs). Significant relationships were found among these three variables. It was additionally found that a high implementation level of LPS practices is usually associated with improved project performance, although it is not always associated with improved network metrics. The results give insights into project performance relationships with the organization and LPS practices that ought to result in improving the managerial decision-making process concerning organizational structure and management practices for better project performance.